PB80-194657

Impact of New Source Performance Standards on 1985 National Emissions from Stationary Sources

Research Corp., of New England
Wethersfield, CT

Prepared for

Environmental Protection Agency
Research Triangle Park, NC

Apr 77

U.S. Department of Commerce
National Technical Information Service
NTIS

PB80-194657

EPA-450/3-76-017
April 1977

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON 1985 NATIONAL EMISSIONS FROM STATIONARY SOURCES

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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SPRINGFIELD, VA 22161

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO.
EPA 450/3-76-017

2.

3. RECIPIENT'S ACCESSION NO.
PB 80 194657

4. TITLE AND SUBTITLE
Impact of New Source Performance Standards on 1985 National Emissions from Stationary Sources

5. REPORT DATE
April 1977

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)
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William A. Marrone

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
TRC - The Research Corporation of New England
125 Silas Deane Highway
Wethersfield, Connecticut 06109

10. PROGRAM ELEMENT NO.
2AC129

11. CONTRACT/GRANT NO.
68-02-1382

12. SPONSORING AGENCY NAME AND ADDRESS
EPA-Office of Air Quality Planning and Standards
Emission Standards and Engineering Division
Research Triangle Park, NC 27711

13. TYPE OF REPORT AND PERIOD COVERED
Task Final; 7/74 - 7/76

14. SPONSORING AGENCY CODE
EPA - OAQPS

15. SUPPLEMENTARY NOTES
Project Officer for this Report is
G. D. McCutchen, Mail Drop 13, Ext. 271

16. ABSTRACT

The purpose of this document is to present the results of a study to determine the impact of new source performance standards on nationwide emissions. The work presented covers 14 potential pollutants from approximately 200 source categories for the year 1985. The results are being used by EPA as input to the development of an overall standard setting strategy. The report contains information regarding controlled and uncontrolled emission factors, State emission limitations, industrial capacity, utilization, growth and retirement rates. The results of this study have been published as three volumes which encompass ten separate documents. This document contains the main text and Apendices I through III of Volume I. All input/output variables and results are summarized and tabulated in this volume.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS		c. COSATI Field/Group
Air Pollution Air Pollution Control Industrial Processes Combustion Regulations Economic Factors	Priorities Chemical Industry Paper Industry Petroleum Industry	Metal Industry Agricultural Mineral Flyash Exhaust Gases	

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (9-73)

*U.S.GOVERNMENT PRINTING OFFICE: 1977- 740110/302 REGION NO. 4

EPA-450/3-76-017

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by

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Contract No. 68-02-1382

EPA Project Officer: Gary D. McCutchen

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
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April 1977

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Publication No. EPA-450/3-76-017

FOREWORD

During 1974, two studies were initiated that ultimately resulted in the establishment of priorities for developing and promulgating New Source Performance Standards (NSPS). The procedures used to determine these priorities produced a great deal of information that is believed to be useful in the industries involved and, accordingly, is being published in this series of reports (EPA-450/3-76-017, EPA-450/3-76-018, EPA-450/3-76-019, and EPA-450/3-76-020). This information is organized as follows:

EPA-450/3-76-017 discusses (1) the mathematical model (Model IV) used to determine NSPS impacts over a 10-year period; (2) the methods used to attain input variables; and (3) the summary tables which are the heart of this study. Included in the summary tables are data related to (1) emission, growth, and replacement rates; (2) present and future production and capacity; (3) nationwide emissions; and (4) NSPS impact. These tables include information on 13 pollutants and nearly 200 stationary source categories.

EPA-450/3-3-76-018-a, -b, -c, -d, -e, and -f are the calculation sheets, showing how the input variables reported in EPA-450/3-76-017 were derived. All information sources, assumptions, and calculations are documented and explained. The appropriate worksheets are arranged alphabetically in the following volumes:

018-a - Stationary Combustion Sources
018-b - Chemical Processing Industries
018-c - Food and Agricultural Industries
018-d - Mineral Products Industries
018-e - Metallurgical Industries
018-f - Miscellaneous Sources (Evaporation Losses, Petroleum Industry, Wood Products Industry, and Assembly Plants

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The 018-a -f series is of interest only to those concerned with the detailed calculations used to determine the Model IV input variables.

EPA-450/3-76-019-a provides additional results and information produced during the priority study. Its major purpose is to describe the computer program used to rank all the Model IV input and output variables by pollutant (these rankings are reported in 019-b and -c). In addition, it contains (1) summaries of the control systems considered "best" for each source, (2) equipment retirement ages, and (3) emission trends for each source category.

EPA-450/3-76-019-b and c present the computer-generated ranked data for each pollutant. Ranking is from highest to lowest for each of the 21 variables, e.g., A (nationwide capacity) and E_u (uncontrolled emission rate). Volume 019-b contains ranked data for particulate, nitrogen oxide (NO_x), and sulfur oxide (SO_x) sources. In Volume 019-c, the remaining pollutant sources are ranked: hydrocarbons, carbon monoxide (CO), fluorides, hazardous material, acid mist, lead, ammonia, sulfides, chlorine, and trace metals.

EPA-450/3-76-020, the final document in this series, takes the objective impact values from EPA-450/3-76-017, adds subjective judgements, and uses these combined criteria to produce a priority list for NSPS development. The report then calculates nationwide emission trends over the next 15 years for each criteria pollutant (particulate, SO_x, NO_x, hydrocarbons, and CO) based on a series of scenarios (e.g., no NSPS, 20 NSPS per year, etc.)

In summary, documents EPA-450/3-76-017 and 020 present the results of this study. Each stands alone, but they also complement each other, with 020 building on the results of 017. The remaining documents (018-a -f and 019-a -c) present additional and/or more detailed information derived from the impact and priority studies.

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1.0 SUMMARY

Section 111 of the Clean Air Act charges the Administrator of the Environmental Protection Agency with the responsibility of establishing Federal standards of performance for new stationary sources which may significantly contribute to air pollution. These new source performance standards (NSPS) will reflect the degree of emission limitation achievable through application of the best demonstrated control methods, considering cost. Due to limited manpower and funding, it is not feasible to set standards for all sources simultaneously and, therefore, an overall strategy is being developed to delineate the priorities by which such standards should be set. This strategy will focus attention on those sources for which NSPS control would have the greatest impact on reducing the quantity of atmospheric emissions. Estimates of the projected differential in emissions with and without anticipated NSPS is to serve as the basis for determining these standard-setting priorities.

The purpose of this document is to present the results of a study to develop such estimates for approximately 200 source categories. These "emission impact" calculations have been performed using a generalized priority rating system developed by EPA known as Model IV(1). The Model has been computerized to permit refinement of data as new or more up-to-date information becomes available.

The results of this study are presented for the year 1985 and are based on the premise that standards for all 200 source categories are promulgated in the year, 1975. Our findings indicate that in 1985, a potential reduction of nearly 71* million tons of total pollutants could be realized through new source standards. On a source basis, this potential reduction in atmospheric emissions ranges from several million tons of total pollutants per year to zero. Of the total 71 million tons, nearly 38% is attributable to the control of carbon monoxide followed by 23% for control of SO_x. NSPS controls for oxides of nitrogen were shown to be the least effective for all the criteria pollutants (7% of the total potential reduction). Controls for all pollutants from stationary combustion sources would account for the greatest, or 57%, of the total potential reduction that could be achieved by NSPS. These totals, for the most part, are process emissions since fugitive emissions were generally not included in our study. Very little information regarding fugitive emission rates are available in the literature. Of the total 71 million tons potential reduction, nearly 31% is attributable to the total control of open burning sources.

The results of the study presented herein will become an integral part of the overall strategy plan to establish actual priorities for the standard setting process. Since these results only provide an estimate of control in preventing atmospheric emissions, they must be considered along with many other factors in the development of such a strategy plan. These factors would include, but not be limited to, the availability of adequate control and test methods, the relationship of standards to the economy, the availability of fuel and raw materials, energy requirements, pollutant priorities and geographical distribution of pollution sources.

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*Although EPA's policy is to use the metric system in all its documentation, certain non-metric units are used in this report both for convenience and to reflect original data. Readers more familiar with metric units may use the conversion factor table on page 101.

2.0 INTRODUCTION

The Environmental Protection Agency (EPA) is preparing to establish a long-range schedule for promulgating new source performance standards (NSPS). In order for these future NSPS to be most effective, an overall strategy or plan of action is being developed so that priorities for standard setting can be established. This master plan will take into account the impact of standards on atmospheric emissions, pollutant priorities, completion dates of research and development studies on control technology, availability of test methods, manpower for standards development, geographical distribution of sources, effects on ambient air quality and anticipated economic factors. The purpose of this document is to present the results of a program to calculate the impact of NSPS on air pollutant emissions from sources within the United States.

These calculations have been performed using a generalized priority rating system known as Model IV(1), which mathematically expresses the differential in atmospheric emissions that could be expected with and without NSPS. For example, a maximum emission differential would be observed for a source for which a stringent standard of performance was technically feasible, but for which there were no existing state emission limitations. On the other hand, a minimum or zero emission differential would be observed for a source if a standard of performance representing best control technology was generally equal to existing state regulations. This priority rating system is applied to approximately 200 source categories and the results are listed in decreasing order of potential emission reduction in a later section of the report.

The Model by which emission impact is calculated uses 1975 capacity as the baseline to which estimated growth and obsolescence rates over the next ten years are applied to obtain the new and modified capacity that could be regulated by NSPS in the period 1975 to 1985. The best available level of control is then applied to this capacity to determine the level of emissions under NSPS control in 1985. For comparison, another set of emission levels is determined for 1985 by applying to this same new and modified capacity the control levels stipulated by state regulations, or (in the absence of applicable regulations) uncontrolled emission levels. Both sets of emission levels represent maximum values based on capacity. They are then tempered by a capacity utilization factor to convert emission levels from operation at capacity to operation at production rates anticipated in 1985. The difference between the two values of emission levels represents the control effectiveness of NSPS for a specific pollutant within a source. This is the first step in determining the order of standard setting since priority attention should be given to source categories for which the greatest potential for emission reduction can be expected.

Conclusions drawn from the study and appropriate recommendations are submitted in Sections 3.0 and 4.0, respectively.

Section 5.0 of this report presents a detailed description of Model IV, the factors which comprise it and the calculation procedures, assumptions and judgments employed. Both typical and unique cases are presented as well as a discussion of the general reference material used. A classification of source categories and their known and suspected pollutants is presented to include subcategorization for those sources where a variety of processes, techniques or equipment necessitated an independent evaluation.

Section 6.0 presents, in tabular form, a summary of the results and the prime and intermediate variables employed in the Model. This section also includes a discussion of sources for which no control technology has been demonstrated and a description of the control of odorous emissions and major U.S. odor sources.

In Section 7.0, an analysis of the applicability of Model IV is made by describing in detail the effect of the input variables on the ultimate value of emission impact. Cautions regarding the use and limitations of the Model and the input variables are presented. Significant results are summarized and unusual or special cases are pointed out.

The three appendices of this report and Volume EPA-450/3-76-018-a through -018-f, dealing with the determination of input variable for calculation of input of New Source Performance Standards, should be considered an integral part of this study. Appendix 1 of this report lists all data sources used in the development of Model IV input factors. Appendix 2 summarizes the industrial categories investigated with a list of the applicable data sources for each industry. Appendix 3 presents a printout of the computer program developed to perform the calculations. It is coded in Fortran IV format for use with a Xerox 530 computer and can be easily modified for any computer system which uses the same language format.

EPA-450/3-76-018-a through -018-f are the calculation sheets for each source and pollutant evaluated. They document the data sources, assumptions and calculation procedures employed. These sheets contain additional details regarding historical trends within the category, plant locations and sizes, projections of growth and the potential for change, alternate sources of data, value and confidence levels of the input variables, alternate control techniques and interrelationships of various industrial categories.

3.0 CONCLUSIONS

Based on our application of the EPA Model IV and the results obtained by its use, TRC draws the following conclusions:

(1) In our opinion, Model IV provides an adequate basis by which to establish estimates of the effect of new source performance standards in preventing atmospheric emissions. While it is not applicable to all emission sources, the Model permits an evaluation of the vast majority and provides a basis upon which an overall strategy for the standard setting process can be developed.

(2) If it were possible to adopt new source performance standards in 1975 for all the sources evaluated in this study, a potential reduction of approximately seventy-one million tons of pollutants could be realized in 1985. Although such a task is not feasible, this result indicates the need for the development of an overall strategy to maximize the effectiveness of new source emission standards.

(3) The industrial and emission factors used in this study were developed specifically for, and are therefore limited to, Model IV use. Because of this limited application, caution must be exercised if they are used in any other context.

(4) The confidence which can be placed on the calculated value of emission impact decreases as the number of years from the baseline year (1975) increases. This is due, primarily, to the potential difference which could occur between predicted and actual growth rates.

(5) For certain emission sources and pollutants, no control tech-

nology has thus far been demonstrated. For this reason, proper application of the Model to determine emission impact could not be achieved.

(6) Little or no impact on emissions is expected for source categories which show a decreasing capacity and which are generally not replacing obsolete facilities.

4.0 RECOMMENDATIONS

Based on our conclusions and analysis of the results of this study, we submit the following recommendations:

(1) For standard setting, high priority should be given to sources with both a rapid growth rate and significant emissions since extensive control of the source could be recognized in a relatively short time period. The effect of control efforts will be maximized if standards are initiated before a leveling off trend occurs.

(2) Growth and obsolescence rates, fractional utilization rates and capacities for the majority of source categories should be periodically reevaluated to point up any possible changes that could result in a greater impact of standards on emissions. This is particularly important for sources which have shown a decreasing or abnormal growth rate.

(3) A more detailed investigation should be conducted for those sources where production appears to be decreasing. The purpose of this investigation would be to determine the extent to which obsolete facilities are being replaced so that an accurate determination of emission impact can be made.

(4) Research and development efforts for control technology should be accelerated for those sources capable of significant emissions where no control technology has been demonstrated. This should be accomplished as rapidly as possible so that the standard setting process can be initiated.

(5) Overall strategies must be refined to take into account the long-term outlook for the availability and effects of control techniques. Such refinements should consider:

- (a) Optional control methods to be used in the event that changes in fuel or raw material availability render a single control method inadequate.
- (b) Standards for several pollutants from an emission source to preclude the excessive formation of or increase in one pollutant by controlling another.
- (c) Enforcement of proper operating, maintenance and "good housekeeping" practices if these techniques will significantly reduce emissions.
- (d) The geographical distribution of emission sources and the effect of standards on air quality in "high density" areas.

5.0 DISCUSSION

5.1 BACKGROUND

The Clean Air Act(2) of 1970, building on prior Federal, state and local control agency legislation and experience, authorized a national program of air pollution prevention and control which included the following major approaches:

(1) National Ambient Air Quality Standards (Sections 109 and 110). Ambient air concentration (receptor/effect) standards are set by EPA for pollutants affecting public health (primary standards) and/or welfare (secondary standards). Air quality criteria documenting health and welfare effects are issued by EPA prior to setting standards; the six pollutants for which such documents have been published (particulate matter, SO_x, NO_x, hydrocarbons, photochemical oxidants, and CO) are commonly called "criteria pollutants." Standards are attained through EPA-approved state implementation plans designed to achieve and maintain standards on a regional basis.

(2) Emission Standards for Moving Sources (Sections 202, 211, and 231). EPA prescribes standards for motor vehicles which require at least a level of emission reduction mandated by Congress, regulate fuels and fuel additives, and regulate aircraft emissions. These requirements significantly expand prior legislation authorizing motor vehicle standards and fuel additive registration.

(3) National Emission Standards for Hazardous Air Pollutants (Section 112). Emission standards are established by EPA for stationary sources emitting pollutants which "...may cause, or contri-

bute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness." The standards apply to both new and existing sources; enforcement authority may be delegated to the States. These are emission standards rather than ambient air standards but they are based on health effects. Present standards regulate asbestos, beryllium and mercury emissions.

(4) Standards of Performance for New Stationary Sources (Section 111). These are emission standards, established by EPA, which reflect the degree of emission limitation achievable through the application of the best adequately demonstrated system of emission reduction, taking into account the cost of achieving such reduction. They apply only to new or modified sources, with one exception: if the standard is for a "designated" pollutant (i.e., a pollutant which is neither a "criteria" nor a "hazardous" pollutant), then a separate standard is established for existing sources by State agencies (Section 111d).

Standards of Performance for New Stationary Sources are commonly referred to as new source performance standards or NSPS. The first group for which these standards were proposed covered five source categories: fossil fuel-fired steam generators (greater than 250 million BTU per hour), Portland cement plants, municipal incinerators, nitric acid plants and sulfuric acid plants. Standards were promulgated on December 23, 1971. On March 8, 1974, standards were promulgated for an additional seven categories: asphalt concrete plants, petroleum refineries (fluid catalytic cracking regenerators), petroleum storage vessels (greater than 65,000 gallon capacity), secondary lead smelters and refineries, brass and bronze ingot production plants, iron and steel plants (basic oxygen furnace) and sludge incinerators. Standards are presently being proposed for several additional categories: primary copper, lead and zinc smelters. Others are currently under development.

The major objective of new source performance standards is to obviate future air pollution problems rather than to correct them after the fact. The most practical time, from both an economic and technical standpoint, to install pollution control equipment is during the construction phase of a new facility. Add-on systems or devices are more costly than those incorporated in the plant design and they may not represent the application of best technology due to the constraints placed on them by existing structures and process considerations. Pollution control equipment, designed as an integral part of a process or operation, is the most effective means of reducing emissions at the least possible expense. In many instances, proper selection, design and incorporation of controls can result in zero cost or even a savings for new plant operations.

Since NSPS require best demonstrated control technology on new or modified plants, they have the effect of preventing significant quantities of emissions from rapidly growing industries and from extensive plant modification efforts. It is an effective means of minimizing air quality degration, since the standards can be reviewed periodically and modified to reflect advancements in the state-of-the-art of control technology. Future plants or plant modifications would then be subject to the new standard, thus preventing the degradation that would result from the application of "static" regulations to growing sources. In addition, pollutants which are neither "criteria" nor "hazardous" may be controlled for existing sources through application of Section 111(d) of the Clean Air Act. These pollutants are defined as "designated" pollutants.(3)

Due to limited manpower and funding, it is not feasible to set standards on all sources simultaneously and immediately. Accordingly, an overall strategy to delineate priorities is being developed. These priorities are being determined by evaluating the quantitative impact of a standard in terms of emission reduction for a group of sources. Superimposed upon this are other priority and timing factors such as lead times necessary to develop applicable control methods or test procedures and manpower availability.

The purpose of this document is to present the results of a program to develop the quantitative impact of new source performance standards (NSPS) on emissions from approximately 200 source categories. These impact calculations have been performed using a generalized priority rating system known as Model IV(1), which mathematically expresses the differential in atmospheric emissions that could be expected with and without NSPS.

5.2 MODEL IV

Several models have been developed by the EPA for the determination of priorities over the past few years. The first model provided a comparison of source categories based on total atmospheric emissions of all pollutants, availability of control technology, and other factors. The second model focused on the need for individual priorities for each pollutant and attempted to restrict rating criteria to factors selected from a generalized strategy for the pollutant. Impact on emissions was a prime criterion in all cases, but impact was expressed on a relative scale. The third model attempted to emphasize impact, but the relative scale concept was retained. Because impact was expressed in a relative way, the model did not provide a system amenable to gradual refinement as available information was improved. Other models developed by EPA have taken into account toxicity, exposure, ambient air concentrations or population density. These models are generally complex and not amenable to modification or refinement in addition to presenting impact on a relative scale.

Model IV, which is developed below, is amenable to data refinement and provides a quantitative estimate of anticipated impact of standards of performance in preventing atmospheric emissions.

The additional control potential of new or revised standards of performance stems from the application of emission standards that are more stringent than those presently applied to construction and modification. This potential, for a specified time period, is expressed as

$$(T_S - T_N)$$

Where: T_S = Emissions under baseline year control regulations

T_N = Emissions under new or revised standards of performance.

To calculate the control potential of standards of performance, other factors must be considered, such as the portion of growth requirements that can be satisfied from present unused capacity and the obsolescence and replacement rates of existing facilities. Such a comparison can be expressed mathematically.

The following notation is used in the development of the relationship between projected emissions under baseline year (1975) regulations and NSPS control.

T_S = total emissions in i^{th} year under baseline year regulations (tons/yr)

T_N = total emissions in i^{th} year under new or revised NSPS which have been promulgated in the j^{th} year (tons/yr)

T_U = total emissions in i^{th} year assuming no control (tons/yr)

T_A = total emissions in baseline year under baseline year regulations (tons/yr)

K = normal fractional utilization rate of existing capacity, assumed constant during time interval

A = baseline year production capacity (production units/yr)

B = production capacity from construction and modification to replace obsolete facilities (production units/yr)

C = production capacity from construction and modification to increase output above baseline year capacity (production units/yr)

P_B = construction and modification rate to replace obsolete capacity (decimal fraction of baseline capacity/yr)

P_C = construction and modification rate to increase source capacity (decimal fraction of baseline capacity/yr)

E_S = allowable emissions under existing regulations (mass/unit capacity)

E_N = allowable emissions under standards of performance (mass/unit capacity)

E_U = emissions with no control (mass/unit capacity)

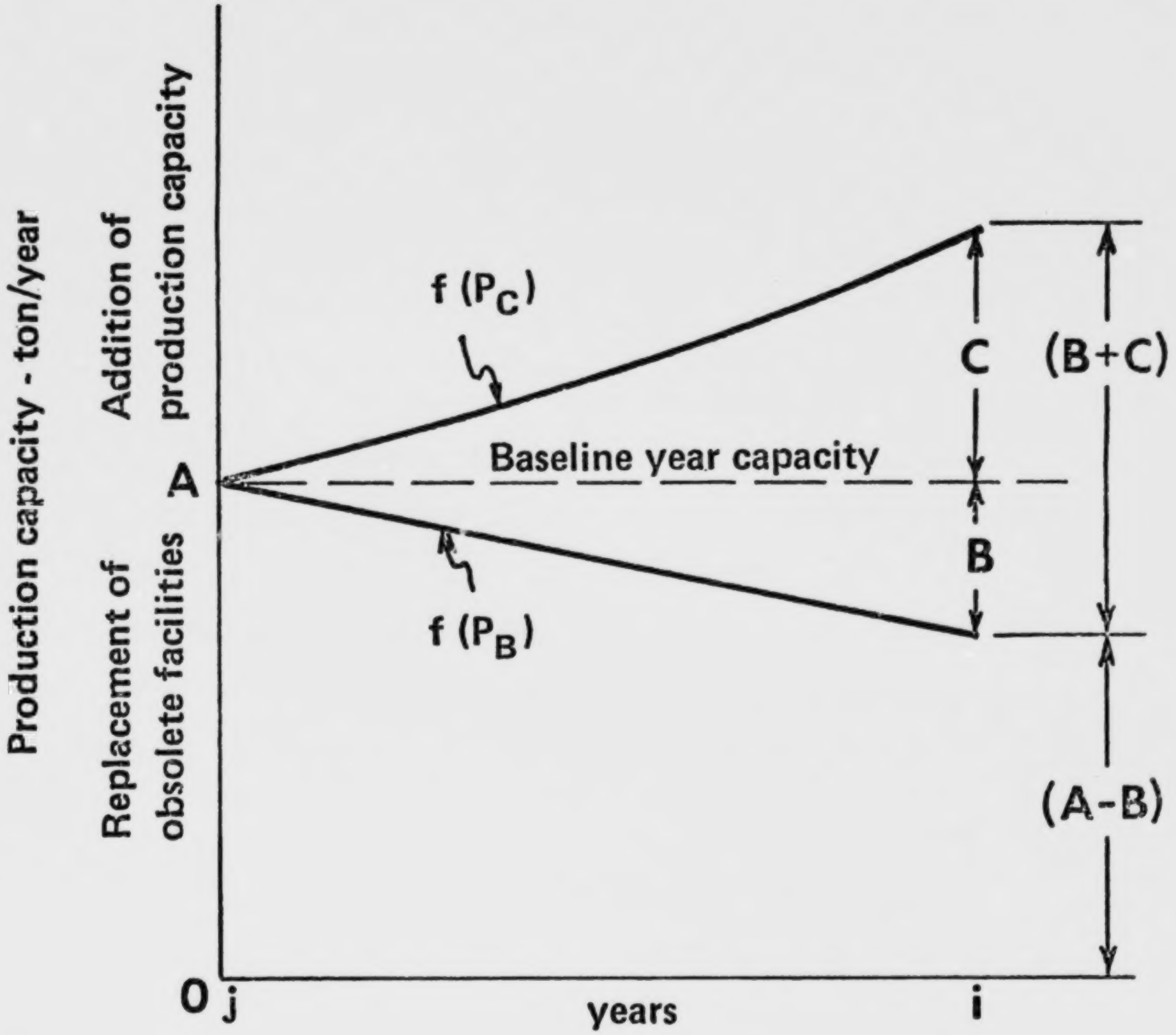
For the purpose of this study the i^{th} year is defined as 1985 and the j^{th} year, 1975.

Assuming that capacity lost due to obsolescence is replaced by construction and modification, as schematically shown in Figure 5-1, then,

$$T_S = E_S K (A - B) + E_S K (B + C) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

and

Applicability of NSPS to construction and modification


Production capacity - ton/year
Addition of production capacity
Replacement of obsolete facilities
f (P_C)
f (P_B)
Baseline year capacity
A
B
C
(B+C)
(A-B)
0
j
years
i

(A-B) = capacity regulated by existing limitations

(B+C) = capacity regulated by NSPS

$$T_N = E_S\, K\, (A - B) + E_N\, K\, (B + C) \quad \ldots\ldots\ldots\ldots \quad (2)$$

$$T_S - T_N = K\, (B + C)\, (E_S - E_N) \quad \ldots\ldots\ldots\ldots \quad (3)$$

Values of B and C are determined as follows:

(a) If compound growth is assumed,

$$B = A\, [\, (1 + P_B)^i - 1] \quad \ldots\ldots\ldots\ldots \quad (4)$$

$$C = A\, [\, (1 + P_C)^i - 1] \quad \ldots\ldots\ldots\ldots \quad (5)$$

(b) If simple growth is assumed,

$$B = AiP_B \quad \ldots\ldots\ldots\ldots \quad (6)$$

$$C = AiP_C \quad \ldots\ldots\ldots\ldots \quad (7)$$

where

i = elapsed time, years

In addition, the following values may be calculated:

$$T_A = E_S KA \quad \ldots\ldots\ldots\ldots \quad (8)$$

$$T_U = E_U K\, (A - B) + E_U K\, (B + C) \quad \ldots\ldots\ldots\ldots \quad (9)$$

Further refinement of the Model may be realized for cases where E_S for new and existing plants differ. In this case,

$$T_S = KE_{S_1}\, (A - B) + KE_{S_2}\, (B + C) \quad \ldots\ldots\ldots\ldots \quad (10)$$

where:

$E_{S_1} = E_S$ for existing plants

$E_{S_2} = E_S$ for new plants

Therefore,

$$T_S - T_N = K\, (B + C)\, (E_{S_2} - E_N) \quad \ldots\ldots\ldots\ldots \quad (11)$$

Section 111 (d) of the Clean Air Act requires the States to regulate designated pollutants from existing installations for sources to which NSPS have been applied. To handle this situation, a slight modification to the model is necessary. T_U, T_A and T_S are the same as for criteria pollutants. T_N is redefined, however, as

$$T_{ND} = E_{111(d)} K (A - B) + E_N K (B + C) \quad . \; . \; . \; . \; . \; . \; . \; . \; . \quad (12)$$

Where:

$E_{111(d)}$ = allowable emissions under State regulations as required by Section 111(d) of the Act.

T_{ND} = total emissions in i^{th} year under Section 111(d) and NSPS regulations.

Due to the large number of calculations to be performed and the repetitive nature of these calculations, the model has been computerized. A printout of the program can be found in Appendix III.

For the purposes of this study, K, A, P_B and P_C are defined as industrial prime variables. E_S, E_U, E_N and $E_{111\ (d)}$ are defined as emission prime variables. T_A, T_U, T_S, T_N, T_{ND}, B and C are referred to as intermediate variables.

5.3 INDUSTRIAL FACTORS

5.3.1 Normal Fractional Utilization - K

The variable, K, represents that fraction of total existing capacity which is brought into service to produce a given output. By applying this factor to the capacity based values of A, B and C, impact on emissions is determined for actual production. The numerical value of K may be arbitrarily changed to permit a reevaluation of impact on emissions at any production level, if so desired. It is for this reason that K exists within the Model.

K was generally deduced from information available in the literature by simply dividing production by capacity. Occasionally, a direct reference to the value was made. Although the definition appears to be relatively straightforward, the actual value can be interpreted several ways based upon the original definition of the term capacity. Industries generally specify their production capacity in two ways--preferred or physical.(4) Physical capacity is defined as the maximum production that would result if an industry pushed its output to the ultimate practical level. Preferred capacity, on the other hand, is the maximum quantity of production that would result considering equipment limitations, normal operating schedules, maintenance, shutdowns and profits.

Although the values of K were determined from many data sources within the literature, several were exceptionally valuable. The Chemical Economics Handbook(5) gave production and capacity information for many source categories as well as breakdowns of various processes or methods within the category. A great deal of information necessary to develop K was obtained from draft and final reports made available by EPA. In some cases, Department of Commerce Publications, such as the Census of Manufacturers(6) and the Survey of Current Business(4), were used.

Determination of K for source categories that had associated production and capacity data was relatively straightforward. A few source categories, however, did not have an associated production rate and had to be treated differently. Field burning of sugar cane, for example, is a "do or don't" situation. Therefore, K was set equal to unity for this type of process. Emission factors for the dry cleaning industry were developed on a per capita basis with the values of A, B and C being related to population. Since population is, in fact, "capacity", K was set equal to unity. In general, the majority of manufacturing processes had a fractional utilization greater than 0.7. Most were in the 0.8 to 0.9 range.

5.3.2 Production Capacity - A

The variable, A, is defined as production capacity in the baseline year, 1975. It is used to derive the values of new (C) or replaced (B) capacity in 1985 (Equations 4 through 7) and to define existing capacity in 1985 not subject to NSPS (A - B). Production capacity was generally determined from production data found in the literature for some year other than 1975. This value was converted to capacity in 1975 by dividing by fractional utilization, K, and scaling this value by P_C to 1975. For those cases where actual capacity was quoted in the literature, it was not necessary to divide by K.

The units for capacity were selected to be consistent with those used by the specific category and which were compatible with the other factors. In most cases, tons of product or tons of feed per year were chosen. However, for the phosphate fertilizer industries, tons of P_2O_5 per year was chosen since production and capacity information is commonly quoted on this basis. For combustion sources, A was expressed in BTU's or horsepower - years per year. For incinerators, tons of refuse handled annually was specified. Occasionally, the value of capacity was chosen in terms of a quantity to which emission or growth factors could be related. An example of this is degreasing for which tons of metal cleaned, not the quantity of solvent used, was selected. Tons of clothes cleaned annually was chosen as the basis for the dry cleaning analysis. A growth rate within the industry based on anticipated population trends could then be employed.

The most recent production or capacity data available was used so that extrapolation to the baseline year would result in as realistic a value as possible. In nearly all cases, data sources were more recent than 1967; much data were from the 1970's. Several sources were exceptionally valuable, notably those mentioned previously in the discussion regarding fractional utilization. Others included the Chemical Profiles series(7), Particulate Pollutant System Study(8), EPA control techniques documents and Hydrocarbon Pollutant Systems Study(9).

5.3.3 Increase in Industrial Capacity Over 1975 Capacity - P_C

The variable, P_C, is defined as the average anticipated growth rate in source capacity during the period of 1975 to 1985. It is expressed as a fraction and is applied to A, production capacity, to determine C, (Equations 5 and 7). It is this value of C to which NSPS can be applied.

P_C was determined by several methods, the most general being extrapolation of historical production or capacity data to the year 1985. A second relatively common approach was to relate the anticipated number of new plants and the average new plant capacity to 1975 capacity levels. A third alternative was based on "expert predictions" from sources such as Department of Commerce, associated trade associations, cognizant industry personnel or from studies performed by a number of organizations such as the Stanford Research Institute (5) or the Environmental Protection Agency.

For categories whose function is directly related to population, Department of Commerce data regarding population trends was employed to determine P_C.

A growth rate based on "expert predictions" or extrapolation of data for the ten year period, 1975 to 1985, is subject to the many biases which could occur during that period. For example, availability of raw materials, sudden changes in demand or consumption patterns or economic factors such as cost of money and price controls could alter historical trends or invalidate "expert predictions". As a result, the impact of standards would be subsequently altered.

As shown in Equations 5 and 7, P_C may be expressed as either a compound or simple growth rate. If the historical growth pattern was indeed compound in nature, the value of P_C was calculated by the following equation:

$$P_C = \sqrt[x-y]{\frac{\text{Capacity in year "x"}}{\text{Capacity in year "y"}}} - 1.0 \quad . \; . \; . \; . \; . \; . \; . \; . \quad (13)$$

where $x > y$

If the historical growth pattern was simple in nature, the value of P_C was calculated by the following equation:

$$P_C = \frac{\text{Capacity in year "x"} - \text{Capacity in year "y"}}{(x-y)\ \text{Capacity in 1975}} \quad . \; . \; . \; . \quad (14)$$

where $x > y$

For the case of simple growth, it is necessary to relate the growth to the baseline year, 1975, as shown above. For compound growth, the rate can be applied to any year.

For the majority of cases, P_C was approximated by a compound rate and based on the most recent data available to preclude major inaccuracies in the determination of emission impact.

There were several cases where the anticipated growth rate exceeded 10% annually. Industries characterized by both a rapid growth rate and significant emission rates are prime candidates for NSPS since almost complete control of the source can be recognized in a relatively short time period. Since this rapid growth rate will eventually level off, the use of the Model should not be extrapolated too far beyond the baseline year or an unrealistic value of emission impact could result. Future growth rates for these sources should, therefore, be carefully monitored.

For several sources such as lead pigment manufacture or ROP triple superphosphate production, a continuing downward trend in capacity was noted. This characteristic was associated with sources being phased out due to replacement by more efficient processes, or the demand for whose product was declining because of the availability of a better or cheaper product. For the purpose of our study, we assumed that these sources did not replace obsolete facilities due to the lack of economic incentive. Accordingly, there would be no new or modified capacity generated between 1975 and 1985 that could be controlled by NSPS. However, under Section 111d of the Clean Air Act, the States are required to regulate designated pollutants from existing installations for sources to which NSPS have been applied. It was necessary, therefore, to determine T_S, T_{ND} and $(T_S - T_{ND})$ for those sources with decreasing production capable of emitting designated pollutants. Values for the year 1985 are included in Section 6.0, Presentation of Results. In addition, values for each year between 1975 and 1985 are presented in Section 7.0, Analysis. This has been done since the emission impact is greatest in 1976 and diminishes throughout the ten year period due to the decreasing capacity.

For several other sources, a zero growth rate was observed. We assumed, however, that obsolete facilities were replaced, thereby permitting an emission impact calculation to be performed on the value B, the obsolete production capacity replaced between 1975 and 1985.

5.3.4 Replacement Rate of Obsolete Production Capacity - P_B

The variable, P_B, is defined as the average rate at which obsolete production capacity is replaced during the period 1975 to 1985. It is expressed as a fraction and is applied to A to determine B, (Equations 4 and 6). It is this value of B to which NSPS can be applied. Also, the quantity, (A-B), defines the existing production capacity in 1985 to which only State regulations are applicable.

P_B was determined by one of three methods. One approach was to relate the number of known or estimated plant closings and the average existing plant capacity to 1975 capacity levels. A second method was based on known equipment lifetime. For example, if a major piece of production equipment had an actual estimated lifetime of 50 years, it would depreciate at a rate of 2% per year on a simple basis. The third, and most common, method was to use depreciation guidelines published by the Internal Revenue Service(10). The allowance permitted by the IRS is an economic factor used for tax collection purposes and generally depreciates equipment and facilities over a shorter term than their actual useful life. We assumed for the purpose of this study, therefore, that typical equipment and facilities within each source category evaluated had a useful life equal to twice that allowed by the IRS. As a general rule, P_B was based on very limited data and, as a result, a great deal of judgment was necessary. For this reason, P_B was selected on the basis of straight line depreciation (simple) to avoid compounding potential errors.

5.4 EMISSION FACTORS

5.4.1 Uncontrolled Emission Factor - E_U

The variable, E_U, is the emission factor representing a condition of no control. It is used to calculate T_U, the uncontrolled emissions in 1985, the value to which T_S and T_N may be compared to determine the nationwide impact on emissions of regulations in general. E_U is also employed to develop E_N, the NSPS controlled emission factor. When the efficiency of a control device is stated, application of this efficiency to E_U results in the calculation of E_N. Thirdly, E_U replaces the value of E_S, the emission factor representing control to the extent required by State regulations, when no regulations for a source exist in a given state.

E_U, in most cases, represents a totally uncontrolled emission factor. On occasion, however, it represents the controlled emission factor at the exit of a control device if such a device is integral with the process. An example of this would be carbon black manufacture by the furnace process where the product is actually collected by a series of control devices. If these devices were not functional, the process could not operate.

Determination of E_U was relatively straightforward and references in the literature were abundant. Compilation of Air Pollutant Emission Factors, AP-42(11) and Air Pollutant Emission Factors(12) were major reference sources for this value. Uncontrolled emission factors for particulates were determined for many sources from the Particulate Pollutant Systems Study(8). Occasionally, E_U for a specific process or operation was synthesized from several independent values of E_U. Examples were fossil fuel fired boilers, gas turbine engines and internal combustion engines where the value of E_U was determined by weighting the emission factors for each fuel type by the fraction of the total heating value supplied by each fuel. For certain sources, E_U was synthesized by weighting the emission factors from different portions of an operation by the fraction of total capacity associated with that operation. It is for this reason that the value of E_U developed for this study should not be used in any other context or erroneous conclusions could result.

Units for E_U were chosen to be consistent with the units selected for A, production capacity. For example, if A were in terms of tons of product per year, E_U would be specified in terms of pounds of emissions per ton of product. For those cases where literature quotations for E_U were on a different basis than A, it was necessary to make the proper conversion. Generally speaking, emission factors for fugitive emissions were not included within the study even though for certain sources fugitive emissions may be greater than emissions from point sources. This is an area where further study is necessary to quantitatively assess the importance of this category of sources and to develop methods for emission control.

5.4.2 Controlled Emission Factor - E_N

The variable, E_N, is the emission factor representing the condition of best control applied to new sources. It is used to determine T_N, the emissions that would exist in 1985 if NSPS were applied. When T_N is subtracted from T_S, the quantitative value of emission impact is determined. The units of E_N were chosen to be consistent with those selected for E_U.

A literature search was conducted to find the best level of control that could be applied to new or modified construction. The information came from a wide variety of references. In addition to those mentioned for E_U, which occasionally gave controlled emission factors, the IGCI surveys(13, 14) and feature articles and process summaries from various trade magazines such as Chemical Engineering were exceptionally valuable. The determination of E_N was accomplished by one of three methods. The first, and most common, was directly from information regarding a well-controlled plant. The second method was by applying a stated control hardware efficiency to the value of E_U. When no reference to control techniques was made, a transfer of technology from similar processes was assumed where it was deemed applicable.

There were several instances where technology to control a specific pollutant within a category had not been demonstrated and for which a transfer of technology was judged not feasible in our opinion due to technical or economic reasons or for which no control efforts were ever made due to a low associated point source emission rate. For those cases, E_N was developed by assuming the anticipated level of control that would result if present research and development efforts are successful. For those cases where no specific research and development efforts are presently underway, we set $E_N = 0.0$ to determine the maximum hypothetical impact on emissions if the pollutant were to be completely controlled. The purpose of this application was to develop a separate listing of source categories, ranked in order of hypothetical emission impact, from which priorities for control technology research and development efforts can be developed. The results are weighted towards categories for which there are no present control efforts ($E_N = 0.0$). They should not be compared to the values determined for the majority of cases where control technology has been demonstrated or where a transfer of technology was judged feasible. This listing is therefore presented separately in Tables 6-1 through 6-13.

The values of E_N determined for this study were based on present levels of control technology as determined from the literature. It is possible, however, that nationwide plant surveys for each category could locate more efficient techniques for unique installations which have not been presented in the literature. Such an effort was beyond the scope of this project. It is also recognized that advancements in the state-of-the-art of control technology will occur and the value of E_N will consequently change as time goes on.

5.4.3 Controlled Emission Factor For Designated Pollutants - $E_{111(d)}$

The variable, $E_{111(d)}$, is the emission factor which represents best control applied to designated* pollutants from existing plants. It is used to determine T_{ND}, the emissions of a designated pollutant that would exist in 1985 for existing plants under State control and new plants under NSPS. Section 111(d) of the Clean Air Act[2,3] requires the States to draft, maintain and enforce regulations for the control of designated pollutants from existing sources for which NSPS have been set for new sources within that category. As a result, the Model was modified to reflect this situation (see Equation 12). When T_{ND} is subtracted from T_S, the quantitative value of emission impact for designated pollutants is determined. Units are identical to E_N.

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*For the purpose of this study the following pollutants are defined as designated: fluorides, trace metals, acid mist, lead, ammonia, sulfides, chlorine and odors.

Determination of $E_{111(d)}$ was accomplished in a manner similar to E_N. Control techniques or levels, however, differed in that retrofit technology was necessary for existing plants. In most cases, we believe that available control technology for new installations could also be retrofit to existing installations . Of course, there would be specific instances at certain individual plants where this might not be possible due to existing structures and prohibitive costs.

Equation (12) was also used to calculate controlled emissions of "hazardous" pollutants as defined in Section 112 of the Clean Air Act. However, $E_{111(d)}$ was replaced by E_N, since both new and existing sources would be controlled.

5.4.4 Estimated Allowable Emission Under 1975 Regulations - E_S

The variable, E_S, is the emission factor which represents the 1975 level of control required under State, local, regional or Federal regulations. It is used to determine T_S, emissions in 1985 under baseline year regulations. When T_N is subtracted from T_S, the quantitative impact of NSPS on emissions is calculated.

To determine the applicable regulations, tabulations were made on a State by State, pollutant by pollutant, and source by source (where applicable) basis. This was done by updating and augmenting all summary tables published in Analysis of Final State Implementation Plans(15) (to August 1974) by reviewing all the State regulations as published in the Environment Reporter(16). Federal regulations for new sources promulgated under Section 111 of the Clean Air Act were also incorporated. Ready access to all regulations was thereby provided in tabular form. No effort was made to account for anticipated state regulations beyond 1975.

The value of E_S was usually a weighted average of all existing regulations and/or E_U if no regulations existed. Weighting was generally determined on the basis of production capacity distribution as outlined below.

$$E_S = \sum_{i=1}^{N} E_{S_i} A_i \quad \dots\dots\dots\dots\dots\dots (15)$$

where:

E_{S_i} = Regulation in ith State.

A_i = Decimal fraction of total capacity located in ith State.

i = Individual State

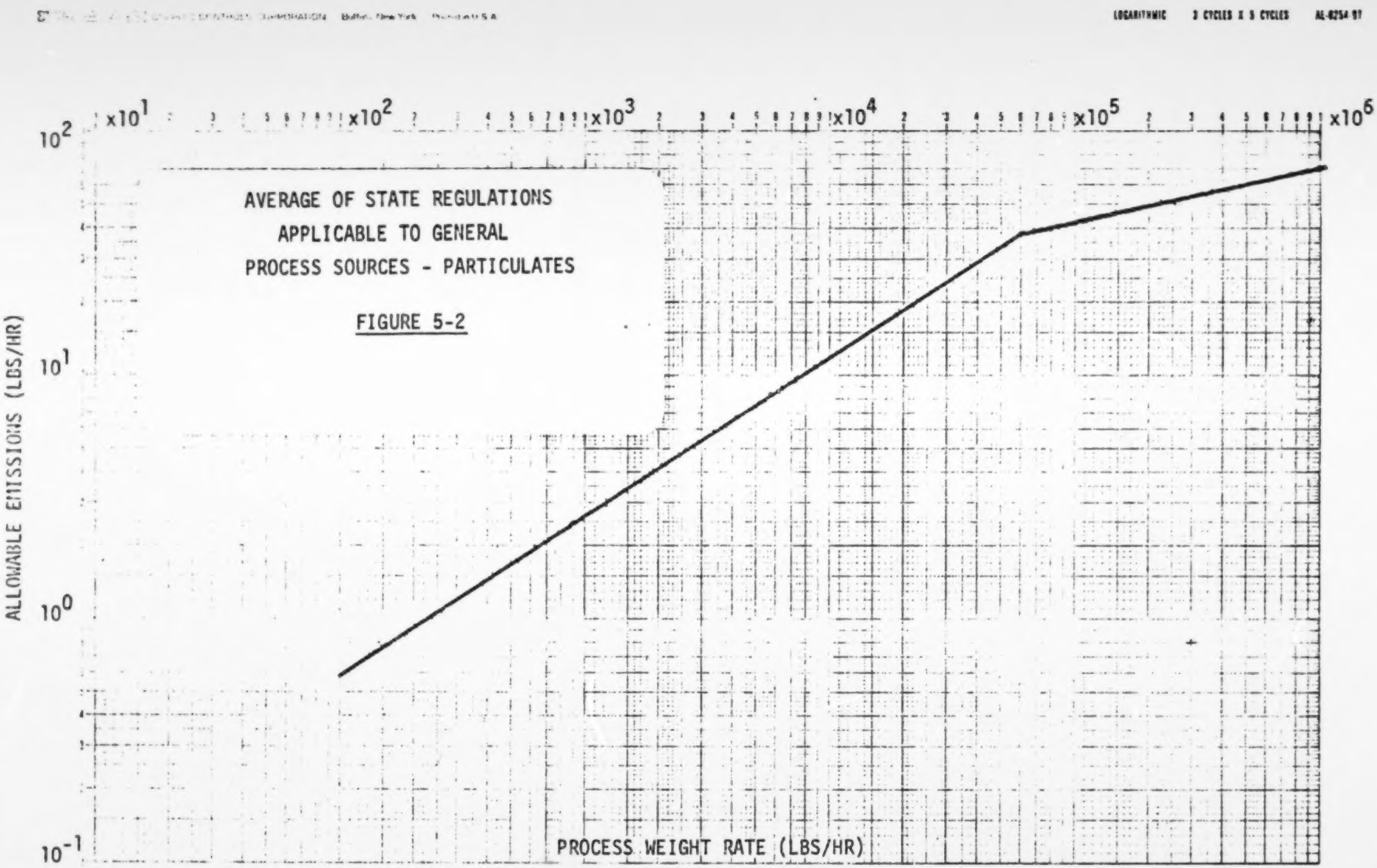
N = Total number of States over which capacity is distributed

Since the units of E_S and E_{S_i} had to be the same as those chosen for E_U and E_N, it was necessary to convert the majority of regulations into the appropriate units. For example, a particulate emission regulation in pounds per hour was converted to pounds per ton by dividing by the typical plant size on a tons per hour basis.

Determination of E_S for particulate emissions from general processes required a series of calculations. For most States, a process weight curve constitutes the regulation. To determine the allowable emissions in pounds per hour for each State, we first determined the process weight rate in tons per hour for a typical plant in that State. This was done by dividing the production capacity in the State by the number of associated plants. This was in turn converted from an annual rate to an hourly rate by applying the number of annual operating hours. Since this value was generally in terms of output capacity, we then developed a feed to product ratio which converted output to input capacity--the value required by the process weight rate curve. The allowable emission in pounds per hour from the curve was divided by the output capacity to obtain E_{S_i} in proper units. When these calculations had been made for each State of concern, the average value of E_S was determined as described by Equation (15). This is a typical example of E_S determination. There were many variations and special case situations too numerous to mention here. Details of the various calculations for each industrial category can be found in the appropriate Appendices.

There were many cases where sources of particulate emissions were distributed throughout all States and specific data regarding geographical distribution was lacking. For these cases, we developed a generalized process weight rate curve by linearly averaging the process weight curves of all the States at each production level. The resulting curve is presented in Figure 5-2. It is slightly less stringent than the curve originally issued as the EPA guideline and slightly more stringent than a curve generated by weighting the process weight curves of the twenty-five most populated States on the basis of fractional population distribution. Similar generalizations were developed for the particulate, NO_x and SO_x regulations for fuel burning sources.

For hydrocarbon emission sources, the value of E_S is related to the reactivity of the pollutant since different regulations apply to reactive and non-reactive hydrocarbons. For the case of reactive emissions, we determined the typical plant size within each state of concern, calculated the hourly emission rate and applied the "percent control" regulation, if it existed, to determine whether the hourly or "percent control" emission regulation was applicable. After converting the result for each State to



AVERAGE OF STATE REGULATIONS
APPLICABLE TO GENERAL
PROCESS SOURCES - PARTICULATES

FIGURE 5-2

pounds per ton, a weighting process, as shown in Equation (15) was performed. As was the case for general process particulate emission E_S determination, there were many variations and special case considerations too numerous to mention here. Details of the various calculations for each source category can be found in the appropriate Appendices.

For several cases, State regulations for new sources differed from existing sources. Consequently, two values of E_S were determined and applied to the Model as shown in Equation (10).

Regulations pertaining to visible emissions were not included in the evaluation of E_S due to the impracticality of converting stated opacity levels to a weight rate of emissions for use in the Model.

5.5 Source Categories

A list of approximately 200 major industries, processes and operations within the United States potentially capable of emitting pollutants into the atmosphere was provided by the EPA. These source categories were classified into ten general groups as outlined below for the purpose of emission impact analysis:

I Stationary Combustion Sources
II Chemical Process Industry
III Food and Agricultural Industry
IV Mineral Products Industry
V Metallurgical Industry
VI Evaporation Loss Sources
VII Petroleum Industry
VIII Wood Products Industry

IX Assembly Plants

X Waste Disposal (Non-Combustion)

Each major group is subdivided into several associated source categories. These subdivisions have been further divided into individual processes, size constraints and equipment types when an independent emission impact analysis was warranted. These category breakdowns were necessary when there was a difference between the level of and/or types of pollutants, growth rates, process rates or applicable control technology. The impact of NSPS on emissions from a specific source, group of sources or an entire major classification may be reviewed by organizing the list in this manner.

The list presented in Table 5-1 identifies by means of X's the known or suspected pollutants associated with each process and operation evaluated, and which are judged to be candidates for NSPS. Fourteen pollutants have been identified for the purpose of this study. The list is flexible and it may be added to, deleted from, or modified if need be so that new processes or industries, or those that are being phased out may be accounted for.

TABLE 5-1. STATIONARY SOURCES OF AIR POLLUTION

	PARTICULATE	NO_x	SO_x	HC	FLUORIDE COMPOUNDS	CO	TRACE METALS	HAZARDOUS POLLUTANTS	ACID MIST	LEAD	AMMONIA	SULFIDES	CHLORINE	ODORS
I. STATIONARY COMBUSTION SOURCES														
BOILERS, FOSSIL FUEL														
$<0.3 \times 10^6$ BTU/hr	X	X	X	X		X	X							
$0.3\text{-}10 \times 10^6$ BTU/hr	X	X	X	X	X	X	X							
$10\text{-}250 \times 10^6$ BTU/hr	X	X	X	X	X	X	X							
$>250 \times 10^6$ BTU/hr	X	X	X	X	X	X	X							
Mixed Fuel														
Coal & Refuse	X	X	X											
Oil & Refuse	X	X	X											
Wood Waste	X													
ENGINES, STATIONARY														
Gas Turbines														
Electric Utility	X	X	X			X								
Pipe Line	X	X	X			X								
Internal Combustion														
Spark Ignition (Heavy Duty Gas Fired)		X		X		X								
Diesel and Dual Fuel	X	X	X	X		X								
INCINERATORS														
Auto Body	X	X		X		X								
Conical	X	X	X	X		X								
Industrial/Commercial	X	X	X	X		X								X
Municipal	X	X	X	X		X							X	X
Pathological	X	X		X		X	X							X
Sludge	X						X							X
MISCELLANEOUS COMBUSTION														
Open Burning														
Commercial/Industrial	X	X	X	X		X								X
Agricultural	X	X		X		X								X
Orchard Heaters	X		X	X		X								
Combustion of Waste Crankcase Oil										X				
II. CHEMICAL PROCESS INDUSTRY														
ACIDS														
Adipic		X												
DMT/TPA (Nitric Acid Oxidation)		X												
Hydrochloric														
By-product									X					
Salt									X					
Hydrofluoric	X		X		X									
Nitric		X												
Phosphoric														
Wet Process					X									
Thermal Process	X													
Sulfuric			X						X					
ACRYLONITRILE				X		X								
AMMONIA														
Methanator plant				X							X			
Regenerator & CO-absorber plant				X		X					X			
CARBON BLACK														
Channel process	X			X		X								
Furnace process	X			X		X						X		

TABLE 5-1. STATIONARY SOURCES OF AIR POLLUTION (CONT.)

II. CHEMICAL PROCESS INDUSTRY (CONT.)	PARTICULATE	NO_X	SO_X	HC	FLUORIDE COMPOUNDS	CO	TRACE METALS	HAZARDOUS POLLUTANTS	ACID MIST	LEAD	AMMONIA	SULFIDES	CHLORINE	ODORS
CHARCOAL	X			X		X								
CHLOR-ALKALI														
Diaphragm cells						X							X	
Mercury cells						X		X					X	
CRUDE OIL & NG PRODUCTION - SULFUR RECOVERY			X									X		
DETERGENT	X													X
ESSENTIAL OILS														X
ETHYLENE DICHLORIDE (OXYCHLORINATION PROCESS)				X		X								
ETHYLENE OXIDE				X										
EXPLOSIVES														
High	X	X	X											
Low		X	X											
FORMALDEHYDE				X		X								
FUEL CONVERSION - COAL GASIFICATION														
High BTU Gas												X		
Low BTU Gas												X		
LEAD PIGMENT										X				
MALEIC ANHYDRIDE (BENZENE OXIDATION)				X		X								
PAINT	X			X										
PHTHALIC ANHYDRIDE														
Naphthalene				X		X								
O-xylene				X		X								
PRINTING INK				X										
SOAP	X													X
SODIUM CARBONATE														
Solvay Process	X										X			
Natural	X													
SYNTHETICS														
Fibers														
Acetate				X										X
Dacron	X													X
Nylon	X			X										X
Viscose Rayon												X		X
Polyethylene														
High Density				X										
Low Density				X										
Polypropylene	X			X										X
Polystyrene				X										
Polyvinyl Chloride	X			X										X

TABLE 5-1. STATIONARY SOURCES OF AIR POLLUTATION (CONT.)

II. CHEMICAL PROCESS INDUSTRY (CONT.)	PARTICULATE	NO_X	SO_X	HC	FLUORIDE COMPOUNDS	CO	TRACE METALS	HAZARDOUS POLLUTANTS	ACID MIST	LEAD	AMMONIA	SULFIDES	CHLORINE	ODORS
SYNTHETICS														
Resins														
ABS-SAN				X										X
Acrylic				X										
Alkyd				X										
Phenolic				X										X
Polyester	X													
Urea Melamine				X										
SBR Rubber	X			X										X
VARNISH				X										X
III. FOOD AND AGRICULTURAL INDUSTRY														
AGRICULTURAL														
Cotton Ginning	X							X						
Fertilizer														
Ammonium sulfate	X													
Diammonium phosphate	X				X						X			X
Granulated triple superphosphate														
Production					X									
Storage	X				X									
Nitrate	X	X									X			X
Normal superphosphate	X				X									X
ROP triple superphosphate	X				X						X			X
Superphosphoric acid														
Submerged combustion	X				X				X					X
Vacuum Evaporation					X									X
Pesticides								X						X
FOOD														
Animal feed defluorination	X				X									
Animal husbandry														X
Beer processing	X			X										X
Canneries														X
Castor bean processing	X			X										X
Coffee roasting	X	X		X										X
Deep fat frying	X			X										X
Direct firing of meats	X			X										X
Feed milling & storage														
Alfalfa dehydrating	X													
Other	X													
Fish processing (fish meal cookers & driers)	X											X		X
Grain handling & processing														
Transfer	X													
Screening, cleaning	X													
Drying	X													
Processing	X													
Meat packing														X
Meat smoke houses	X			X		X								X
Poultry processing														X
Rendering														X
Starch manufacturing	X													X
Stockyards & Slaughterhouses														X
Sugar Cane processing	X													
Bagasse burning	X													
Field burning	X	X		X		X								
Vegetable oil manufacturing	X			X										X
Whiskey processing	X			X										X
OTHER														
Pharmaceuticals								X						
Tanneries														X

TABLE 5-1. STATIONARY SOURCES OF AIR POLLUTION (CONT.)

	PARTICULATE	NO_x	SO_x	HC	FLUORIDE COMPUNDS	CO	TRACE METALS	HAZARDOUS POLLUTANTS	ACID MIST	LEAD	AMMONIA	SULFIDES	CHLORINE	ODORS
IV. MINERAL PRODUCTS INDUSTRY														
ASPHALT														
Batching	X		X	X										X
Roofing														
Saturator	X													X
Blowing	X			X		X								X
CONCRETE														
Batching	X													
Cement plants (Kilns, clinker coolers)	X	X	X											
MINING														
Sand and gravel	X													
Stone quarrying & processing	X													
Lead ore	X									X				
PROCESSING														
Brick and related clay products	X	X	X	X	X	X								
Calcium carbide	X		X	X		X								
Castable refractory	X				X									
Ceramic clay	X	X			X				X					
Clay and flyash sintering														
Clay	X													
Flyash	X													
Coal cleaning (thermal drying)	X		X											
Fiberglas														
Wool processing	X	X	X	X	X	X								X
Textile processing	X	X	X		X	X								X
Frit	X				X		X							
Glass														
Soda lime glass	X	X	X											
Opal glass	X	X	X		X									
Gypsum	X													
Lime	X	X	X											
Mineral wool	X	X	X	X		X								
Perlite	X													
Phosphate rock														
Calcining	X													
Drying	X													
Grinding	X													
V. METALLURGICAL INDUSTRY														
PRIMARY METALS														
Aluminum smelters	X		X		X									
Coke ovens														
Bee-hive oven	X	X	X	X		X					X	X		X
By-product oven	X	X	X	X		X					X	X		X
Copper smelters	X		X											
Ferroalloy	X					X				X				
Iron & Steel plants														
Blast furnace	X					X	X							
BOF	X				X	X	X							
Electric arc furnace	X				X	X	X							
Open hearth furnace	X				X		X							
Sintering	X		X			X								
Scarfing	X													
Lead smelters	X		X							X				
Zinc smelters	X		X											

TABLE 5-1. STATIONARY SOURCES OF AIR POLLUTION (CONT.)

	PARTICULATE	NO_x	SO_x	HC	FLUORIDE COMPOUNDS	CO	TRACE METALS	HAZARDOUS POLLUTANTS	ACID MIST	LEAD	AMMONIA	SULFIDES	CHLORINE	ODORS
V. METALLURGICAL INDUSTRY (CONT.)														
SECONDARY METALS														
Aluminum production														
Sweat furnace	X													
Reverb furnace	X								X				X	
Brass & Bronze smelting	X						X			X				
Cast Iron foundry														
Core ovens				X										X
Cupola furnace	X					X								
Electric furnace	X													
Copper														
Material handling	X													
Smelting & refining	X													
Lead smelter														
Blast furnace	X	X	X				X			X				
Pot furnace	X									X				
Reverb furnace	X	X	X							X				
Magnesium smelting	X	X		X		X								
Steel foundries	X	X												
Zinc														
Distillation	X	X												
Sweating	X	X		X		X								
VI. EVAPORATION LOSS SOURCES														
DEGREASING				X										X
DRY CLEANING				X										
GRAPHIC ARTS														
Gravure				X										X
Flexography				X										X
Lithography				X										X
Letterpress				X										X
Metal decorating				X										X
PETROLEUM STORAGE & TRANSFER														
Nonpipeline transfer (tank cars, trucks & marine)				X										X
Refueling motor vehicles				X										X
Service stations				X										X
Tank storage				X										
INDUSTRIAL SURFACE COATING				X										
TEXTILE PROCESSING														
Heat Setting/Finishing				X										
Texturizing				X										
Carpet manufacturing				X										
VII. PETROLEUM INDUSTRY														
FCCU	X		X			X	X				X			X
GASOLINE ADDITIVES														
Sodium Lead Alloy	X									X				
Electrolytic	X									X				
TCCU AND HCCU	X		X			X	X				X			X
PROCESS GAS COMBUSTION	X	X	X	X										X
VACUUM DISTILLATION				X										
MISC. POINT SOURCES				X										
REFINERY FUEL GAS - SULFUR RECOVERY			X									X		

TABLE 5-1. STATIONARY SOURCES OF AIR POLLUTION (CONT.)

	PARTICULATE	NO_X	SO_X	HC	FLUORIDE COMPOUNDS	CO	TRACE METALS	HAZARDOUS POLLUTANTS	ACID MIST	LEAD	AMMONIA	SULFIDES	CHLORINE	ODORS
VIII. WOOD PRODUCTS INDUSTRY														
WOOD PROCESSING														
Pulpboard	X													
Plywood	X			X										X
WOOD PULPING														
Kraft process (sulfate)	X		X	X		X						X		X
Sulfite	X		X											
NSSC			X											
IX. ASSEMBLY PLANTS														
AUTOMOBILE				X										
CABLE COVER PRODUCTION	X									X				
CAN MANUFACTURING	X									X				
LEAD ACID BATTERY	X			X					X	X				
TYPE METAL PRODUCTION	X									X				
X. WASTE DISPOSAL (NON-COMBUSTION)														
INDUSTRIAL WASTE HANDLING (LIQUIDS)														X
SEWAGE TREATMENT														X

6.0 PRESENTATION OF RESULTS

The impact of NSPS on emissions from those sources presented in Table 5-1 has been evaluated by means of Model IV through the use of equations (1) through (12) as presented in Section 5.2. Using the prime industrial variables K, A, P_B, P_C and the prime emission variables E_S, E_U, E_N, and E_{111d}, the intermediate variables T_A, T_S, T_N, T_{ND}, B, and C were determined. The quantitative value of emission impact for criteria pollutants ($T_S - T_N$) and designated pollutants ($T_S - T_{ND}$) was then calculated for 1985.

Specific reference is made to the Appendices of this volume for (1) a listing of the general reference sources used in this study (2) and a table presenting the specific references used for each source category. EPA-450/3-76-018-a through 018-f present the detailed calculations performed in the development of the prime industrial and emission variables for each source category. The following summary outlines the organization of the three Appendices and volume 018-a through 018-f:

Appendix 1 Bibliography - lists the title and source of all references used in this study

Appendix 2 Specific References - defines those references that were specifically used for each industrial category

Appendix 3 Model IV Computer Program

EPA-450/3-76-018-a Determination of Input Variables for Stationary Combustion Sources

EPA-450/3-76-018-b Determination of Input Variables for the Chemical Process Industry

EPA-450/3-76-018-c	Determination of Input Variables for the Food and Agricultural Industry
EPA-450/3-76-018-d	Determination of Input Variables for the Mineral Products Industry
EPA-450/3-76-018-e	Determination of Input Variables for the Metallurgical Industry
EPA-450/3-76-018-f	Determination of Input Variables for Evaporation Loss Sources
EPA-450/3-76-018-g	Determination of Input Variables for the Petroleum Industry
EPA-450/3-76-018-h	Determination of Input Variables for the Wood Products Industry
EPA-450/3-76-018-i	Determination of Input Variables for Assembly Plants.

6.1 SUMMARY OF INPUT/OUTPUT VARIABLES

Tables 6-1 through 6-13 present the prime variables, intermediate variables, and values of emission impact for five criteria pollutants, six designated pollutants, trace metals and other hazardous pollutants. These tables are summarized as follows:

Table No.	Table Name	Page
6-1	Summary of Input/Output Variables for Model IV - Particulates -	52
6-2	Summary of Input/Output Variable for Model IV - Oxides of Nitrogen -	60
6-3	Summary of Input/Output Variables for Model IV - Oxides of Sulfur -	63
6-4	Summary of Input/Output Variables for Model IV - Hydrocarbons -	66

Table No.	Table Name	Page
6-5	Summary of Input/Output Variables for Model IV - Carbon Monoxide -	73
6-6	Summary of Input/Output Variables for Model IV - Fluoride Compounds -	76
6-7	Summary of Input/Output Variables for Model IV - Hazardous Pollutants -	78
6-8	Summary of Input/Output Variables for Model IV - Acid Mist -	79
6-9	Summary of Input/Output Variables for Model IV - Lead -	80
6-10	Summary of Input/Output Variables for Model IV - Ammonia -	81
6-11	Summary of Input/Output Variables for Model IV - Sulfides -	82
6-12	Summary of Input/Output Variables for Model IV - Chlorine -	83
6-13	Summary of Input/Output Variables for Model IV - Trace Metals -	84

For each pollutant, the results are presented in order of decreasing emission impact in tons per year for 1985. A complete dissolution of subcategory groups was made so that the results could be presented in this manner.

The hypothetical values of impact developed for those sources where technology to control a specific pollutant has not been demonstrated were not included in the main listing but rather, were broken out and appear separately at the bottom of each table. As discussed in Section 5.4.2, these values of emission impact reflect an anticipated level of control and represent the potential of NSPS to control a pollutant once future research and development efforts are completed. The results can be used to help develop priorities for such efforts.

Emission impact values are presented in terms of tons/yr whereas the intermediate values of T_A, T_S, T_N, and T_{ND} are in terms of thousands of tons/yr. The units for the prime emission variables are defined in the tables and are compatible with the units given for the industrial variables A, B, and C. The factors necessary to convert from English to metric units are presented in Table 6-23. Caution should be exercised when abstracting information from the tables to preclude separating a value and the associated units of that value. Growth rates (P_C) and replacement rates (P_B) are presented as decimal fractions with appropriate notation as to whether they are simple (S) or compound (C).

6.2 SUMMARY OF EMISSION IMPACT CALCULATIONS

Summaries of the impact of standards on pollutant emissions are presented in Tables 6-14 through 6-22 for the processes and operations outlined in Table 5-1.* The values are presented categorically to permit ready access to the results for a specific source, a group of similar sources or an entire category. Subtotals are presented where appropriate. The factors necessary to convert from English to metric units are presented in Table 6-23. The Tables are identified as follows:

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* There is no table for Category X sources since odor is the only associated pollutant (see pages 47 ff)

Table No.	Table Name	Page
6-14	Impact of New Source Performance Standards on Emissions From Stationary Combustion Sources in 1985	85
6-15	Impact of New Source Performance Standards on Emissions From The Chemical Process Industry in 1985	87
6-16	Impact of New Source Performance Standards on Emissions From The Food and Agricultural Industry in 1985	90
6-17	Impact of New Source Performance Standards on Emissions From The Mineral Products Industry in 1985	92
6-18	Impact of New Source Performance Standards on Emissions From The Metallurgical Industry in 1985	94
6-19	Impact of New Source Performance Standards on Emissions From Evaporation Loss Sources in 1985	96
6-20	Impact of New Source Performance Standards on Emissions From The Petroleum Industry in 1985	98
6-21	Impact of New Source Performance Standards on Emissions From The Wood Products Industry in 1985	99
6-22	Impact of New Source Performance Standards on Emissions From Assembly Plants in 1985	100

As previously mentioned, several sources or industrial processes have shown a decreasing capacity combined with a failure to replace obsolete facilities. These sources are noted in the Tables with impact values presented for those cases with designated pollutants only. Hypothetical impact values based on anticipated future control levels for certain pollutants are indicated in the Tables; however, the values are not included in any subtotals or totals for the source categories.

6.3 SUMMARY OF ODOR ANALYSIS

The impact of new source performance standards for odorous emissions has not been evaluated by Model IV. Odors are generally treated by means of nuisance regulations (State Implementation Plans and local codes) which, if they exist, do not specify maximum acceptable levels of odor emission at the source in quantitative terms. The regulations are generally written such that the perception of an odor in the community from a defined source constitutes a violation of air pollution laws. Some states have developed procedures for assessing community odor occurences by means of specified odor panels.

Three states (Connecticut, Illinois, and Minnesota) actually limit source odor levels, however, the regulations only apply to a few selected sources or certain stack discharge configurations. Nine states have regulations that require controls for specific source categories. These controls are normally stated in terms of incineration /residence time and temperature requirements or an equivalent method achieving the best practical level of control. Overall, there does not exist a significant body of existing regulations directly applicable to odor. While legislation has addressed itself to odor problems occuring in the community, the definition of acceptable source emission rates is still a problem due to the difficulty in choosing and weighting the various parameters which describe the characteristics of the odor.

An odor may be described by the following four terms: (1) odor level or concentration, (2) odor objectionability, (3) odor intensity, and (4) odor character (smells like). It has been shown that there are relationships between the first three parameters(19), however, the exact relationship differs for each odorant. One odor source having the same odor level as a second may in fact have a higher degree of objectionability and possibly a lower intensity level. This implies that the true assessment of an odor problem may not always be related strictly to the odor level but could also include consideration of the qualitative terms of objectionability, intensity, and character. After reviewing the available literature, we determined that there was a general lack of specific and definitive data to define the quantitative and qualitative aspects of emissions from specific sources. Accordingly, we feel that Model IV cannot be applied to determine the impact of NSPS on odorous emissions.

Surveys have been conducted(17) to assess the major sources responsible for community odor complaints in the U.S. Complaints concerning odor occurrence are registered frequently by municipal and state environmental agencies. Communities differ from one another in the types of sources or activities occurring within their bounds, in their geographical/climatological characteristics, and in the socio-economic makeup of their respective populations; therefore, we would not expect many areas to experience the same odor problems. Notwithstanding these differences between communities, there are a number of source categories which elicit frequent complaints. These categories, for the most part, are found among the chemical processing or food processing industries.

The specific sources of odors from many source categories have been identified and, in many cases, the chemical species responsible for these odors have also been identified. Table 6-24 presents information regarding specific odor sources, chemical species, quantitative odor emission levels, and applicable control systems for several major source categories for which data was available.

Odors are not generally caused by a single odorous compound but rather, a complex mixture of many chemical species. In addition, many compounds will produce a detectable odor at concentrations in the parts per billion (ppb) range. The choice of a technique to control odorous emissions must be selected taking into account the nature of the odorous substances as well as the operating characteristics of the process producing the odor. The control strategies which have been generally applied to odor reduction are identified as follows: (1) process change or modification, (2) chemical or thermal oxidation, (3) adsorption and (4) source modifications.

"Good housekeeping" practices and sanitary measures at slaughtering plants and the design of proper excess air and zone mixing in recovery furnaces at Kraft pulp mills are examples of process changes or improvements. These practices, when properly employed, ensure that the generation of odorous compounds is kept to a minimum, if not eliminated. Thermal oxidation, or incineration, is a widely used method for odor control. If sufficiently high temperature and residence time are maintained in the incinerator, complete oxidation of all combustible material occurs, thereby eliminating most if not all of the odor causing compounds. If, however, the temperature is too low or the residence time is too short, partial oxidation could occur and result in the generation of compounds potentially more odorous than the original species.

Chemical oxidation methods employing mediums such as sodium hypochlorite and potassium permanganate have been used to control odors. This technique involves a chemical reaction between the oxidant and the compounds present resulting in oxidation of the odorous material. The degree of oxidation and, therefore, the odor reduction potential, is a function of the concentration of the oxidizing solution, the stability of the odorous compounds, and the physical parameters governing the intimate contact of the two. Chemical oxidation has been applied successfully to inedible rendering plants and pulp mills where amine and sulfide compounds, respectively, are responsible for odor problems.

Activated carbon is most often used when adsorption is chosen to control a particular odor source. This technique is generally applicable to a wide range of hydrocarbons and has also been used to control hydrogen sulfide emissions. If an activated carbon system is employed, the gas stream to be treated must be relatively free of particulate matter to preclude possible plugging of the carbon. Pretreatment of the exhaust gas with a scrubber or baghouse may be necessary to permit the use of an adsorber system. Adsorption is particularly suitable when recovery of solvents is desired. Many synthetic dry cleaning establishments, for example, recover the perchlorethylene cleaning solvent from the dryer exhaust, since the high cost of this material would not permit these plants to operate economically unless recovery was practiced.

The dilution of stack gases in the free atmosphere may provide a solution to some odor problems. In general, a greater amount of dilution will occur for greater heights of effluent discharge. This may be accomplished by discharging through physically taller stacks or by increasing the temperature and velocity of the stack gases. This means of odor control does not prevent the discharge of odorous compounds but rather uses the dilution capabilities of the atmosphere to reduce the ground level concentrations below the odor threshold.

It is evident that a significant quantity of odorous emissions are related to sulfide compounds. Application of NSPS to sulfides could, therefore, have a direct bearing on the reduction of odor from a given source. It is also conceivable that measures designed to control hydrocarbon emissions may simultaneously reduce odorous emissions.

TABLE 6-1

PARTICULATES

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/Year	A 1975	B 1985	C ' 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
OPEN BURNING (Agricultural)	1.00	lb/ton waste burned	17.0	17.0	0.00	.009c	.00s	10^6 tons waste	280.0	0.0	26.2	2380.0	2603.1	0[1]	2603100
BOILERS 0.3 - 10 x 10^6 BTU/HR	.25	lb/10^6BTU	.25	.25	.048	.043c	.037s	10^{12}BTU	26471	9794	13857	827	1260	663	597000
BOILER > 250 x 10^6 BTU/HR [2]	.58	lb/10^6 BTU	3.11	.277 Exist .100 New	.05	.065c	.050s	10^{12}BTU	28011	14006	19836	2250	2106	1616	490000
BOILERS 10 - 250 x 10^6 BTU/HR	.32	lb/10^6BTU	2.02	.383 Exist .334 New	.127	.014c	.050s	10^{12}BTU	19534	9767	2914	1197	1277	856	420581
GRAIN HANDLING (Processing)	.82	lb/ton grain processed	6.0	2.16	.03	.015c	.037s	10^6 tons grain	239.6	88.7	38.5	212.2	246.3	135.2	111000
STONE QUARRYING AND PROCESSING	.80	lb/ton rock processed	15.5	.379	.155	.033s	.050s	10^6 tons rock	1225	613	404	186	247	156	91100
GRAIN HANDLING (Transfer)	.82	lb/ton grain transferred	20.0	1.94	.20	.015c	.037s	10^6 tons grain	239.6	88.7	38.5	190.6	221.2	130.5	90700
INDUSTRIAL/COMMERCIAL INCINERATION	.38	lb/ton waste burned	6.47	6.47	.065	.11c	.059s	10^6 tons waste	32.6	12.71	59.97	40.1	113.8	25.35	88450
SUGAR CANE (Field Burning)	1.00	lb/acre burned	225.0	225.0	0.0	.015s	0.0	10^6 acres	.6	0.0	.1	75	84	0[1]	84000
GRAIN HANDLING (Screening, Cleaning)	.82	lb/ton grain cleaned	6.0	1.61	.06	.015c	.037s	10^6 tons grain	239.6	88.7	38.5	158.2	183.5	102.8	80800
BOILERS (Wood Waste)	.58	lb/ton wood burned	27.5	5.01	.28	.012c	.050s	10^6 tons wood	162.9	81.4	20.6	142.2	160.2	79.4	80800
BY-PRODUCT COKE OVENS	.93	lb/ton coke produced	4.9	4.9	.43	.010s	.028s	10^6 tons coke	75.5	21.1	7.5	172.0	189.2	129	59600
LIME	.90	lb/ton lime produced	203.0	3.4	.203	.050r	.050s	10^6 tons lime	26.1	13.1	16.4	40.0	65.2	22.7	42500
STEEL FOUNDRIES (Secondary)	.90	lb/ton steel produced	10.4	2.2	.104	.073s	.028s	10^6 tons steel	29.3	8.2	21.4	29.0	50.2	22.3	27900
CAST IRON FOUNDRY (Electric Furnace)	.93	lb/ton cast iron produced	4.5	4.5	.045	.136s	.028s	10^6 tons cast iron	8.1	2.3	11.0	16.9	40.0	12.5	27500
PRIMARY COPPER	.85	lb/ton copper produced	405.0	37.9	1.22	.030c	.036s	10^6 ton copper	2.4	.87	.83	38.8	52.2	25.7	26400

[1] En was applied to both new and existing capacity

[2] $E_{s_{new}}$ based on existing NSPS

TABLE 6-1 (Continued)

PARTICULATES

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
ASPHALT BATCHING[2]	.47	lb/ton asphalt produced	15.0	.376 Exist .169 New	.045	.050s	.008s	10^6 tons asphalt	1480	118	740	131	154.3	129.3	25000
WOOD PROCESSING (Plywood)	.95	lb/sq.ft. plywood produced	.132	.004	.0013	.025c	.050s	10^6 sq.ft. plywood	22600	11300	6330	43	55	32	22600
SAND AND GRAVEL PROCESSING	.80	lb/ton sand & gravel pro.	.10	.10	.005	.000s	.050s	10^6 tons sand & gravel	1142	571	0	46	46	24	21700
DIRECT FIRING OF MEATS	.62	lb/unit-yr	2445.0	2445.0	195.6	.033s	.050s	10^6 units	.0337	.0168	.0111	25.5	34.0	14.5	19600
GLASS PRODUCTION (Soda Lime Glass)	.80	lb/ton glass produced	2.00	1.89	.02	.028s	.033s	10^6 tons glass	34.4	11.4	9.6	26.0	33.3	17.6	15700
PRIMARY ALUMINUM SMELTERS	.92	lb/ton aluminum produced	92.0	5.82	1.80	.075c	.035s	10^6 tons aluminum	6.0	2.1	6.4	16.1	33.1	17.5	15700
WHISKEY	.95	lb/1000 gal. whiskey produced	43.6	27.9	2.18	.06s	.032s	10^9 gal whiskey	1.304	.417	.782	17.28	27.6	13.0	14600
VEGETABLE OIL MANUFACTURING	.92	lb/ton vegetable oil produced	63.0	8.63	.63	.027s	.028s	10^6 tons vegetable oil	6.5	1.8	1.8	25.9	32.9	19.7	13200
BRICK AND RELATED CLAY PRODUCTS	.80	lb/ton clay products produced	130.5	2.77	1.32	.027s	.033s	10^6 tons clay products	35.7	11.8	9.6	39.6	50.2	37.8	12400
MIXED FUEL BOILERS (Coal & Refuse)	.58	lb/ton refuse burned	366.0	5.00	3.66	17.3s	.000s	10^6 tons refuse	.12	.0	27.0	0.2	39.3	28.9	10600
PHOSPHATE ROCK (Grinding)	.94	lb/ton rock ground	2.0	.94	.002	.043s	.050s	10^6 tons rock ground	25.7	12.8	11.1	11.4	16.2	5.7	10600
AMMONIUM SULFATE FERTILIZER	.84	lb/ton ammonium sulfate produced	20.0	2.04	1.0	.116c	.045s	10^6 tons ammonium sulfate	9.3	4.2	18.5	7.9	23.8	13.9	9900
CONCRETE BATCHING	1.0	lb/ton concrete produced	.1	.098	.01	.03c	.033s	10^6 tons concrete	326.6	108	112	16.0	21.5	11.8	9680
IRON & STEEL PLANTS (Electric Arc)	.90	lb/ton steel produced	28.3	4.49 Exist 1.00 New	.48	.073s	.028s	10^6 tons steel	36.7	10.3	26.8	74.2	70.0	61.3	8700

TABLE 6-1 (Continued)

PARTICULATES

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
NITRATE FERTILIZER	.77	lb/ton ammonium nitrate produced	12.72	1.64	.254	.070c	.045s	10^6 tons ammonium nitrate	10.5	4.7	10.2	6.6	13.1	5.1	7900
COAL CLEANING (Thermal Drying)	.59	lb/ton coal dryed	19.8	.410 Exist .340 New	.099	.029s	.060s	10^6 tons coal	133	66.5	38.6	16.0	18.6	11.1	7500
GRAIN HANDLING (Drying)	.82	lb/ton grain dryed	6.0	.77	.06	.015c	.037s	10^6 tons grain	47.9	17.7	7.7	15.1	17.5	10.2	7400
BEER PROCESSING	.81	lb/1000 gal beer produced	5.45	2.09	.27	.070c	.040s	10^9 gal beer	7.2	2.9	7.0	6.1	12.0	4.7	7300
FEED MILLING (Other than Alfalfa Dehydrating)	.50	lb/ton feed produced	20.0	2.06	.1	.035c	.029s	10^6 tons feed	21.4	6.2	8.8	11.0	15.5	8.2	7300
MIXED FUEL BOILERS (Oil and Refuse)	.58	lb/ton refuse burned	101.5	5.00	1.02	17.3s	.000s	10^6 tons refuse	.036	.0	6.2	0.1	9.1	1.9	7200
IRON & STEEL PLANTS (Sintering)	.90	lb/ton sinter produced	42.0	.50	.15	.029s	.028s	10^6 tons sinter	69.6	19.5	20.2	15.7	20.2	14.0	6200
DEEP FAT FRYING	.81	lb/ton food processed	11.9	7.13	0.119	.043c	.028s	10^6 tons food	2.6	0.7	1.4	7.6	11.6	5.6	6000
FERROALLOY	.90	lb/ton ferroalloy produced	456.0	22.8	4.56	.015c	.028s	10^6 tons ferroalloy	1.6	0.4	0.3	16.0	18.6	12.9	5600
SYNTHETIC RESINS (Polyester)	.68	lb/ton resin produced	7.0	4.1	.35	.17c	.045s	10^6 tons resin	1.02	.46	3.9	1.4	6.8	1.3	5540
CHARCOAL	.85	lb/ton charcoal produced	352.0	19.5	3.5	.043c	.045s	10^6 tons charcoal	.8	.4	.4	6.6	10.0	4.8	5300
CEMENT PLANTS (2) (Kilns, Clinker Coolers)	.90	lb/ton cement produced	301.0	1.72 Exist .64 New	.45	.030c	.025s	10^6 tons cement	103.0	25.8	35.4	9502	7159.3	7154.4	5200
POLYPROPYLENE	.78	lb/ton polypropylene produced	3.0	2.67	.03	.150c	.003s	10^6 tons polypropylene	1.6	.05	4.9	1.7	6.7	1.7	5100
SODIUM CARBONATE (Natural)	.87	lb/ton soda ash	90.0	1.16	.45	.13c	.045s	10^6 tons soda ash	5.75	2.59	13.4	2.9	9.7	4.7	4950

TABLE 6-1 (Continued)

PARTICULATES

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

CATEGORY	K	Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
		Units	Eu	Es	En	Pc	Pb	Units/Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
COTTON GINNING	1.00	lb/bale cotton	12.0	2.09	.48	.013s	.042s	10^6 bales cotton	10.8	4.5	1.4	11.3	12.8	8.0	4800
CERAMIC CLAY	.80	lb/ton clay produced	175.5	2.75	1.755	.042s	.033s	10^6 tons clay	13.9	4.6	5.8	15.3	21.7	17.5	4100
SYNTHETIC FIBER (Dacron)	.68	lb/ton dacron produced	7.0	1.58	.35	.164c	.045s	10^6 tons dacron	2.295	1.03	8.18	1.23	5.63	1.78	3850
PHOSPHATE ROCK (Drying)	.87	lb/ton rock	14.0	.34	.122	.041s	.050s	10^6 tons rock	43.9	21.9	18.0	6.5	9.2	5.4	3800
PETROLEUM REFINERY - FCCU (2)	.85	lb/bbl feed	.242	.066 Exist .017 New	.010	.042c	.031s	10^6 bbl feed	1506	467	771	42.2	38.1	34.4	3800
MUNICIPAL INCINERATION (2)	.56	lb/ton waste	19.7	4.6 Exist 1.46 New	.99	.046s	.039s	10^6 tons waste	32.5	12.7	14.9	41.9	36.9	33.2	3700
POLYVINYL CHLORIDE	.82	lb/ton PVC produced	35.0	3.18	.35	.078c	.0002s	10^6 tons PVC	2.7	.005	3.1	3.6	7.6	4.0	3600
GYPSUM	.80	lb/ton gypsum produced	151.7	1.51	.302	.006s	.029s	10^6 tons gypsum	15.9	4.7	0.9	9.6	10.2	7.5	2700
DIAMMONIUM PHOSPHATE FERTILIZER	.89	lb/ton P_2O_5 produced	82.0	3.53	1.64	.054s	.045s	10^6 tons P_2O_5	3.1	1.4	1.7	4.9	7.6	5.0	2600
SUGAR CANE (Bagasse Burning)	.75	lb/ton bagasse burned	22.0	3.7	2.2	.015s	.050s	10^6 tons bagasse	7.0	3.5	1.0	9.7	11.2	8.6	2600
ASPHALT ROOFING (Saturator)	.90	lb/ton asphalt input	7.3	1.33	.073	.025s	.042s	10^6 tons asphalt	6.3	2.6	1.6	3.8	4.7	2.3	2400
IRON & STEEL PLANTS (Scarfing)	.90	lb/ton steel scarfed	3.00	.138	.030	.029s	.028s	10^6 tons steel scarfed	87.3	24.4	25.3	5.4	7.0	4.6	2400
STARCH MANUFACTURING	.83	lb/ton starch produced	8.0	2.00	.020	.018c	.045s	10^6 tons starch	4.3	1.9	0.8	3.5	4.2	2.0	2300
INTERNAL COMBUSTION ENGINES (Diesel & Dual Fuel)	.38	lb/hp-yr	5.41	5.41	4.61	.028s	.020s	10^6 hp-yr	18.0	3.6	5.0	28.2	36.1	34.1	2000
PAINT	.85	lb/ton paint produced	1.00	1.00	.001	.026c	.067s	10^6 tons paint	4.9	3.3	1.5	2.0	2.7	0.7	2000
SECONDARY ALUMINUM PRODUCTION (Reverb Furnace)	.82	lb/ton aluminum produced	135.0	4.8	.96	.047s	.036s	10^6 tons aluminum	1.4	0.5	0.7	2.8	4.1	2.3	1900
SECONDARY COPPER (Smelting)	.82	lb/ton copper produced	84.6	3.47	.338	.037c	.035s	10^6 tons copper	1.8	.6	.8	2.6	3.8	1.9	1900

TABLE 6-1 (Continued)

PARTICULATES

SUMMARY OF INPUT/OUTPUT VARIABLES
FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
SECONDARY COPPER (Material Handling)	.82	lb/ton copper produced	212	6.64	.848	.037c	.035s	10^6 tons copper	.7	.3	.3	2.0	2.9	1.5	1400
SYNTHETIC FIBER (Nylon)	.72	lb/ton nylon produced	15.0	1.53	.75	.127c	.045s	10^6 tons nylon	1.715	.77	3.95	.94	3.12	1.80	1320
FEED MILLING (Alfalfa Dehydrating)	.50	lb/ton feed produced	50.0	2.06	.25	.035c	.029s	10^6 tons feed	4.1	1.2	1.7	2.1	3.0	1.7	1300
PETROLEUM REFINERY (Process Gas Combustion)	.85	lb/1000 $ft.^3$ process gas burned	20.0	20.0	3.0	.042c	.031s	$10^{12} ft^3$ process gas	.226	.070	.115	1.9	2.9	1.6	1300
ASPHALT ROOFING (Blowing)	.90	lb/ton asphalt blown	4.2	1.18	.042	.025s	.042s	10^6 tons asphalt	3.1	1.3	0.8	1.7	2.1	1.0	1100
MINERAL WOOL	.82	lb/ton mineral wool produced	32.4	4.27	3.63	.020s	.029s	10^6 tons mineral wool	8.4	2.5	1.7	14.8	17.7	16.6	1100
LEAD ACID BATTERY	.76	lb/battery produced	.13	.032	.00013	.05c	.04s	10^6 batteries	80.0	32.0	50.3	.97	1.58	.59	1000
FLYASH SINTERING	.86	lb/ton flyash sinter produced	110.0	.40	.11	.055s	.033s	10^6 tons flyash sinter	7.7	2.5	5.4	1.3	2.3	1.3	990
FRIT	.80	lbs/ton frit produced	17.8	5.80	1.78	.037s	.033s	10^6 tons frit	.837	.276	.310	1.9	2.7	1.7	940
PHOSPHORIC ACID (Thermal Process)	.81	lb/ton $P_2 O_5$ produced	134	2.27	.134	.014c	.045s	10^6 tons $P_2 O_5$	1.39	.626	.207	1.27	1.468	.747	721
WOOD PROCESSING (Pulpboard)	.98	lb/ton pulpboard produced	.096	.096	.014	.015c	.051s	10^6 tons pulpboard	37.2	11.5	6.0	1.7	2.0	1.3	700
FIBERGLASS (Textile Processing)	.70	lb/ton textiles produced	84.0	2.78	1.46	.122c	.063s	10^6 tons textile	.5	.3	1.1	0.5	1.6	0.9	670
PHOSPHATE ROCK (Calcining)	.90	lb/ton rock calcined	40.0	.96	.40	.048s	.050s	10^6 tons rock	2.5	1.3	1.2	1.1	1.6	1.0	630
PERLITE	.82	lb/ton perlite expanded	21.0	4.35	.84	.036s	.029s	10^6 tons perlite	0.6	0.2	0.2	1.2	1.6	1.0	610
AUTO BODY INCINERATION	.90	lb/auto	2.0	1.97	.54	.280c	.039s	10^6 autos	.3	.1	.8	.3	1.0	.4	600

TABLE 6-1 (Continued)

PARTICULATES

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
CARBON BLACK (Furnace Process)	.77	lb/ton carbon produced	220	3.1	2.2	.025c	.045s	10^6 tons carbon	2.0	.9	.6	2.4	3.0	2.5	500
DETERGENT	.90	lb/ton dryed detergent produced	90.0	1.50	.45	.035c	.000s	10^6 tons dryed detergent	2.5	0.0	1.0	1.7	2.4	1.9	490
GRANULATED TRIPLE SUPER PHOSPHATE (Storage)	.76	lb/ton P_2O_5 produced	2.17	1.11	.022	.042c	.045s	10^6 tons P_2O_5	1.2	.5	.6	.5	.8	.3	470
SECONDARY ALUMINUM (Sweat Furnace)	.68	lb/ton aluminum produced	33.0	7.36	1.98	.047s	.036s	10^6 tons aluminum	.3	.1	.1	.8	1.1	0.7	460
CLAY SINTERING	.80	lb/ton clay sinter produced	26.0	2.41	.026	.027s	.033s	10^6 tons clay sinter	.7	.2	.2	.7	.9	.5	420
MINING AND MILLING OF LEAD ORE	.92	lb/ton lead mined	4.17	4.17	2.09	0	.05s	10^6 tons lead	.622	.311	0	1.2	1.2	.9	297
EXPLOSIVES (High)	.83	lb/ton high explosives produced	50.4	1.55	1.35	.094c	.045s	10^6 tons high explosives	1.8	0.8	2.7	1.2	2.9	2.6	290
GLASS MANUFACTURING (Opal Glass)	.80	lb/ton opal glass produced	2.24	2.24	.022	.028s	.033s	10^6 tons opal glass	.5	.2	.1	.4	.5	.3	250
PRIMARY LEAD SMELTERS	.85 Exist .99 New	lb/ton lead produced	790	3.06	1.19	0.0	.036s	10^6 tons lead	.765	.275	0.0	.99	1.5	.8	250
PRIMARY ZINC SMELTERS	.83	lb/ton zinc produced	1665	3.860 Exist 2.250 New	1.67	.036c	.036s	10^6 tons zinc	1.3	.47	.54	2.1	2.29	2.04	240
SECONDARY ZINC - (Sweating)	.82	lb/ton zinc produced	23.6	3.86	.872	.039c	.055s	10^6 tons zinc	.2	.07	.09	.31	.45	.26	196
SMOKED MEAT	.81	lb/ton meat produced	.3	.3	.1	.017s	.040s	10^6 tons meat	3.6	1.4	.6	.4	.5	.3	170
ANIMAL FEED DEFLUORINATION	.90	lb/ton P_2O_5	625.0	4.57	.063	.000s	.040s	10^6 tons P_2O_5	.2	.1	0.0	.4	.4	.2	160
STYRENE BUTADIENE RUBBER	.75	lb/ton SBR produced	.7	.7	.12	.020c	.003s	10^6 tons SBR	2.3	.07	.5	.6	.8	.6	130
SECONDARY ZINC (Distillation)	.82	lb/ton zinc produced	46.0	2.71	1.70	.039c	.055s	10^6 tons zinc	.38	.13	.18	.42	.62	.49	129
COFFEE ROASTING	.85	lb/ton coffee roasted	7.3	.794	.44	0	.040s	10^6 tons coffee	1.5	.6	0.0	.5	.5	.4	90

TABLE 6-1 (Continued)

PARTICULATES

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
CASTABLE REFRACTORY	.80	lb/ton product	254.0	5.32	4.62	.043c	.033s	10^6 tons product	.39	.13	.2	.8	1.3	1.2	90
SOAP	.90	lb/ton soap produced	13.0	.724	.026	0	.045s	10^6 tons soap	.6	.2	0.0	.2	.2	.1	80
BRASS & BRONZE SMELTING (2)	.80	lb/ton metal produced	70.0	3.25 Exist 1.20 New	.28	.000s	.036s	10^6 tons metal	.375	.135	0.0	.49	.38	.33	50
SECONDARY LEAD (2) (Reverb Furnace)	.68	lb/ton lead produced	277.0	6.44 Exist 1.25 New	1.05	.032c	.024s	10^6 tons lead	.713	.171	.264	1.6	1.37	1.34	30
PATHOLOGICAL INCINERATION	.34	lb/ton waste	12.8	4.6 Exist 3.8 New	1.9	.026c	.039s	10^6 tons waste	.13	.05	.04	.1	.12	.09	29
SECONDARY LEAD (Pot Furnace)	.68	lb/ton lead produced	1.36	1.36	.041	.032c	.024s	10^6 tons lead	.065	.016	.024	.03	.04	.02	20
MAGNESIUM SMELTING	.82	lb/ton magnesium produced	6.78	6.78	.68	.016s	.035s	10^6 tons magnesium	.0175	.006	.003	.05	.056	.034	20
SECONDARY LEAD (2) (Blast Furnace)	.68	lb/ton lead produced	271.0	4.35 Exist 1.25 New	1.05	.032c	.024s	10^6 tons lead	.148	.036	.055	.2	.204	.198	6
FISH MEAL PROCESSING	.81	lb/ton fish meal produced	.4	.4	.04	0	.008s	10^6 ton fish meal	.4	.03	0.0	.07	.06	.05	4
SLUDGE INCINERATION (2)	.50	lb/ton dry feed	119	5.0 Exist 1.60 New	1.60	.25s	.033s	10^6 ton dry feed	1.176	.388	2.94	1.47	2.316	2.316	0
HYDROFLUORIC ACID	.98	lb/ton 100% HF produced	700	35	35	.049s	.045s	10^6 tons 100% HF	.449	.20	.22	7.7	11.49	11.49	0
FIBERGLASS PRODUCTION (Wool Processing)	.70	lb/ton wool produced	96.0	8.64	8.64	.042c	.063s	10^6 tons wool	1.1	0.7	.6	3.3	4.9	4.9	0
IRON & STEEL PLANTS (Blast Furnace)	.90	lb/ton pig iron produced	150.0	1.50	1.50	.029s	.028s	10^6 tons pig iron	118.7	33.2	34.4	48.1	103.3	103.3	0
IRON & STEEL PLANTS (2) (BOF)	.90	lb/ton steel produced	51.0	.208 Exist .150 New	.150	.048s	.028s	10^6 tons steel	88.9	24.9	42.7	8.3	10.6	10.6	0

TABLE 6-1 (Continued)

PARTICULATES

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal /Yr		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
WOOD PULPING (Kraft)	.98	lb/ton pulp produced	198	5.63	5.63	.012c	.031s	10^6 tons pulp	33.9	10.5	4.29	93.5	105.4	105.4	0
WOOD PULPING (Sulfite)	.98	lb/ton pulp produced	24	3.0	3.0	.012c	.031s	10^6 tons pulp	2.4	.74	.3	3.53	3.97	3.97	0
For those cases where there was no demonstrated control technology... **(See P.29)** BOILERS <.3 x 10^6 BTU/HR.	.3	lb/10^6 BTU	.039	.039	0.0	.029c	.020s	10^{12} BTU	24572	4914	8131	144	191	115	76300
STATIONARY GAS TURBINES (Electric Utility)	.22	lb/hp-yr.	3.74	3.74	0.0	.270s	.020s	10^6 hp-yr.	54	11	146	22.3	82.3	17.8	64500
STATIONARY GAS TURBINES (Pipe Line)	.85	lb/hp-yr.	1.18	1.18	0.0	.145s	.020s	10^6 hp-yr.	4.4	.9	6.4	2.2	5.4	1.8	3600
ORCHARD HEATERS	1.00	lb/heater-hr.	.007	.007	0.0	.028s	.033s	10^6 heater hrs.	60.0	19.8	16.8	.2	.3	.1	130

TABLE 6-2

OXIDES OF NITROGEN

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Tm 1975	Ts 1985	Tn 1985	Ts-Tn 1985
STATIONARY GAS TURBINES (Electric Utility)	.22	lb/hp-yr	72.7	72.7	10.9	.270s	.020s	10^6 hp-yr	54.0	11.0	146.0	433.0	1601	534	1060000
BOILERS (2) > 250 x 10^6 BTU/HR	.58	lb/10^6 BTU	.599	.582 Exist .534 New	.428	.055c	.050s	10^{12} BTU	28011	14006	19836	4728	7606	6564	1040900
INTERNAL COMBUSTION ENGINES (Spark Ignition)	.58	lb/hp-yr	230.0	230.0	131.0	.087s	.020s	10^6 hp-yr	28.7	5.7	25.0	1917	3585	2702	882000
BOILERS 10 - 250 x 10^6 BTU/HR	.32	lb/10^6 BTU	.417	.415 Exist .411 New	.138	.014c	.050s	10^{12} BTU	19534	9767	2914	1297	1483	929	553884
OPEN BURNING (Agricultural)	1.0	lb/ton waste burned	2.0	2.0	0.0	.009c	.000s	10^6 tons waste	280.0	0.0	26.2	280.0	306.2	(1) 0.0	306200
EXPLOSIVES (High)	.83	lb/ton explosives produced	169.0	169.0	11.5	.094c	.045s	10^6 tons explosives	1.8	.8	2.7	129	316	87	229000
STATIONARY GAS TURBINES (Gas Pipeline)	.85	lb/hp-yr	60.5	60.5	9.08	.145s	.020s	10^6 hp-yr	4.4	.9	6.4	113	277	118	158000
MIXED FUEL BOILER (Coal and Refuse)	.58	lb/ton refuse	37.5	35.0	15.0	17.3s	0.0s	10^6 tons refuse	.12	0.0	27.0	1.6	275	119	156000
INTERNAL COMBUSTION ENGINES (Diesel & Dual Fuel)	.58	lb/hp-yr	179.0	179.0	123.0	.028s	.020s	10^6 hp-yr	18.0	3.6	5.0	932	1193	1053	140000
BOILERS .3 - 10 x 10^6 BTU/HR	.25	lb/10^6 BTU	.194	.194	.175	.043c	.037s	10^{12} BTU	26471	9794	13857	642	978	922	56200
CEMENT PLANTS (Kilns, Clinker Coolers)	.90	lb/ton cement	2.6	2.6	1.69	.03c	.025s	10^6 tons cement	103.0	25.8	35.4	120.5	162	136.9	25100
INDUSTRIAL/COMMERCIAL INCINERATOR	.38	lb/ton waste burned	1.87	1.87	.65	.11c	.039s	10^6 tons waste	32.6	12.71	59.97	11.6	32.9	16	16850
EXPLOSIVES (Low)	.83	lb/ton explosives produced	41.5	41.5	2.91	.094c	.045s	10^6 tons explosives	.5	.2	.8	8.9	22.0	6.1	15800
MUNICIPAL INCINERATOR	.56	lb/ton waste burned	3.0	3.0	1.1	.046s	.039s	10^6 tons waste	32.5	12.7	14.9	27	40	25	14700
SUGAR CANE (Field Burning)	1.0	lb/ton acre burned	30.0	30.0	0.0	.015s	0.0	10^6 acres	.6	0	.1	9.8	11.2	0.0 (1)	11200

(1) En was applied to both new and existing capacity

(2) $E_{s_{new}}$ based on existing NSPS

TABLE 6-2 (Continued)

OXIDES OF NITROGEN

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
PETROLEUM REFINERY (Process Gas Combustion)	.85	lb/10^6 cubic feet	230	230	115	.042c	.031s	10^{12} cu. ft.	.226	.070	.115	22	33.4	24.3	9100
NITRIC ACID$^{(2)}$ (Air Oxidation)	.88	lb/ton 100% acid	52.5	22.3 Exist 3.0 New	2.0	.078c	.050s	10^6 tons acid	11.4	5.7	12.8	112	80	72	8100
FIBERGLASS (Textile Processing)	.70	lb/ton product	15.3	15.3	2.87	.122c	.063s	10^6 tons product	.5	.3	1.1	2.8	8.8	2.5	6300
ADIPIC ACID	1.0	lb/ton acid produced	12.0	12.0	1.2	.055c	.015c	10^6 tons acid	.8	.1	.6	5.0	8.6	4.7	3900
DMT/TPA (Nitric Acid Oxidation)	.85	lb/ton DMT/TPA produced	13.0	13.0	1.3	.073c	.045s	10^6 tons	.38	.17	.39	2.1	4.3	1.5	2790
MIXED FUEL BOILER (Oil and Refuse)	.58	lb/ton refuse	34.5	15.0	13.8	17.3s	0.0s	10^6 tons refuse	.036	0.0	6.2	.2	27.2	25.1	2200
FIBERGLASS (Wool Processing)	.70	lb/ton product	3.62	3.62	1.57	.042c	.063s	10^6 tons product	1.1	.7	.6	1.4	2.1	1.2	880
AUTOBODY INCINERATION	.90	lb/auto	.10	.10	.02	.280s	.039s	10^6 auto	.3	.1	.8	.013	.050	.017	30
For those cases where there was no demonstrated control technology... (see P.29) BOILERS < .3 x 10^6 BTU/HR	.30	lb/10^6BTU	.081	.081	.04	.029c	.020s	10^{12}BTU	24572	4914	8131	299	397	317	80000
GLASS MANUFACTURING (Soda-Lime Glass)	.80	lb/ton glass produced	5.29	2.04	0.0	.028s	.033s	10^6 tons glass	34.4	11.4	9.6	28	36	19	17100
LIME	.90	lb/ton lime produced	.834	.834	.417	.050c	.050s	10^6 tons lime	26.1	13.1	16.4	9.8	16.0	10.4	5600
STEEL FOUNDRY (Secondary)	.90	lb/ton steel produced	.20	.20	0.0	.073s	.028s	10^6 tons steel	29.3	8.2	21.4	2.6	4.6	1.9	2700
BRICK AND RELATED CLAY PRODUCTS	.80	lb/ton product	.465	.465	.233	.027s	.033s	10^6 tons product	35.7	11.8	9.6	6.6	8.4	6.4	2000
CERAMIC CLAY	.80	lb/ton product	.465	.465	.233	.042s	.033s	10^6 tons product	13.9	4.6	5.8	2.6	3.7	2.7	1000
NITRATE FERTILIZER	.77	lb/ton ammonium nitrate produced	.125	.125	0.0	.070c	.045s	10^6 tons ammonium nitrate	10.5	4.7	10.2	.5	1.0	.3	720

TABLE 6-2 (Continued)

OXIDES OF NITROGEN

SUMMARY OF INPUT/OUTPUT VARIABLES
FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
BYPRODUCT COKE OVEN	.93	lb/ton coke produced	.054	.054	0.0	.010s	.028s	10^6 tons coke	75.5	21.1	7.5	1.9	2.1	1.4	720
PATHOLOGICAL INCINERATOR	.34	lb/ton waste burned	25.0	25.0	0.0	.026c	.039s	10^6 tons waste	.13	.05	.04	.6	.7	.3	380
GLASS MANUFACTURING (Opal Glass)	.80	lb/ton glass produced	5.29	2.04	0.0	.028c	.033s	10^6 tons glass	.5	.2	.1	.4	.5	.2	230
MINERAL WOOL	.82	lb/ton mineral wool	.16	.16	.08	.020s	.029s	10^6 tons mineral wool	8.4	2.5	1.7	.6	.7	.54	160
SECONDARY LEAD (Reverb Furnace)	.68	lb/ton lead produced	5.32	.938	0.0	.032c	.024s	10^6 tons lead	.71	.17	.26	.2	.3	.2	140
COFFEE ROASTING	.85	lb/ton coffee roasted	.1	.1	.05	0.0	.040s	10^6 tons coffee	1.5	.6	0	.1	.066	.061	15
SECONDARY ZINC (Distillation)	.82	lb/ton zinc produced	.072	.072	0.0	.039c	.035s	10^6 tons zinc	.4	.1	.2	Negligible Values			9
SECONDARY LEAD (Blast Furnace)	.68	lb/ton lead	.157	.157	0.0	.032c	.024s	10^6 tons lead	.15	.04	.06	Negligible Values			5
SECONDARY ZINC (Sweating)	.82	lb/ton zinc	.072	.072	0.0	.039c	.035s	10^6 tons zinc	.2	.1	.1	Negligible Values			5
MAGNESIUM SMELTING	.82	lb/ton magnesium produced	.347	.347	0.0	.016s	.035s	10^6 tons magnesium	.0175	.006	.003	Negligible Values			1

TABLE 6-3

OXIDES OF SULFUR

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
BOILERS > 250 x 10^6 BTU/HR(1)	.58	lb/10^6 BTU	1.99	1.80 Exist .97 New	.125	.055c	.05s	10^{12} BTU	28011	14006	19836	14622	16870	8518	8351900
BOILERS 10-250 x 10^6 BTU/HR	.32	lb/10^6 BTU	1.83	1.79 Exist 1.53 New	.259	.014c	.05s	10^{12} BTU	19534	9767	2914	5595	5889	3323	2566300
COPPER SMELTERS	.86	lb/ton copper produced	5000	2503 Exist 2443 New	25.0	.030c	.036s	10^6 tons copper	2.4	.9	.8	2564	3400	1660	1740000
BOILERS 3.-10 x 10^6BTU/HR	.25	lb/10^6 BTU	.77	.77	.207	.043c	.037s	10^{12} BTU	26471	9794	13857	2551	3887	2219	1670000
PRIMARY ZINC SMELTERS	.83	lb/ton zinc produced	2200	2200 Exist 1798 New	33.0	.035c	.036s	10^6 tons zinc	1.3	.5	.5	1200	1520	779	741000
CEMENT (Kilns, Clinker Coolers)	.90	lb/ton cement produced	21.7	21.7 Exist 21.0 New	8.84	.030c	.025s	10^6 tons cement	103	26	35	1006	1352	997	334900
PRIMARY LEAD SMELTERS	.85 Ex. .99 New	lb/ton lead produced	1320	1320	19.8	0	.036s	10^6 tons lead	.77	.28	0	429	455	278	177000
STATIONARY GAS TURBINES (Electric Utility)	.22	lb/hp-yr	16.6	16.6	9.48	.27s	.02s	10^6 hp-yr	54.1	10.8	146.1	98.8	366	243	122000
MIXED FUEL BOILERS (Coal And Refuse)	.58	lb/ton waste burned	224.0	60.0	44.8	17.29s	0.0	10^6 tons waste	.12	0	27.0	2.7	472	353	119000
WOOD PULPING (NSSC)	.98	lb/ton pulp produced	143	143	20.0	.012c	.031s	10^6 tons pulp	4.18	1.30	.53	293	330	220	110000
WOOD PULPING (Sulfite)	.98	lb/ton pulp produced	126	126	20.0	.012c	.031s	10^6 tons pulp	2.4	.7	.3	148	167	113	54000
EXPLOSIVES (High)	.83	lb/ton explosives produced	31.0	31.0	2.48	.094c	.045s	10^6 tons explosives	1.8	.8	2.7	24	58	17	41400
MIXED FUEL BOILERS (Oil And Refuse)	.58	lb/ton waste burned	20.5	20.5	4.1	17.29s	0.0	10^6 tons waste	.036	0	6.2	.2	37	7.6	29600
SECONDARY LEAD (Reverb Furnace)	.68	lb/ton lead produced	212.0	202.0	2.12	.032c	.024s	10^6 tons lead	.7	.2	.3	49	67	38	29600
EXPLOSIVES (Low)	.83	lb/ton explosives produced	65.0	65.0	5.2	.094c	.045s	10^6 tons explosives	.5	.2	.8	14	34	9.8	24500

(1) $E_{s_{new}}$ based on existing NSPS

TABLE 6-3 (Continued)

OXIDES OF SULFUR

SUMMARY OF INPUT/OUTPUT VARIABLES
FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
SULFURIC ACID (1)	.84	lb/ton 100% H_2SO_4 produced	55.0	35.0 Exist 4.0 New	3.0	.053c	.045s	10^6 tons 100% H_2SO_4	49	22	33	717	486	463	23100
REFINERY FUEL GAS - SULFUR RECOVERY	.66	lb/ton sulfur input	75.0	38.4	20.0	.042c	.03s	10^6 tons sulfur	3.6	1.1	1.8	45.2	68.3	50.7	17500
WOOL PULPING (Kraft)	.98	lb/ton pulp produced	5.0	3.06	1.6	.012c	.031s	10^6 tons pulp	34	11	4	51	57	47	10600
COAL CLEANING (Thermal Drying)	.59	lb/ton coal dryed	1.34	.77 Exist .66 New	.33	.029s	.05s	10^6 tons coal	133	67	39	30.2	35	25	10000
CRUDE OIL & NATURAL GAS PRODUCTION - SULFUR RECOVERY	.50	lb/ton sulfur input	47.0	36.0	20.0	.042c	.05s	10^6 tons	2.9	1.0	1.5	25.8	39.0	29.1	9900
LIME	.90	lb/ton lime produced	1.42	1.42	.71	.05s	.05s	10^6 tons lime	36.1	13.1	16.4	16.7	27.2	17.6	9400
FIBERGLASS (Textile Manufacturing)	.70	lb/ton glass produced	16.2	16.2	.04	.122c	.063s	10^6 tons glass	.5	.3	1.1	2.9	9.3	1.1	8200
INTERNAL COMBUSTION ENGINES (Diesel And Dual Fuel)	.58	lb/hp-yr	16.8	16.8	14.3	.028s	.02s	10^6 hp-yr	18.0	3.6	5.0	87.5	112	106	6200
BRICK AND RELATED CLAY PRODUCTS	.80	lb/ton clay product	1.077	1.077	.431	.027s	.033s	10^6 tons clay product	36	12	10	15	19.5	14	5500
FIBERGLASS (Wool Processing)	.70	lb/ton glass produced	6.51	6.51	.04	.042c	.063s	10^6 tons glass	1.1	.7	.6	2.5	3.7	.9	2800
GAS TURBINE ENGINES (Pipeline)	.85	lb/hp-yr	5.27	5.27	4.38	.145s	.02s	10^6 hp-yr	4.4	.9	6.4	9.8	24.1	21.3	2700
ASPHALT BATCHING	.47	lb/ton asphalt produced	.0275	.0275 Exist .0255 New	.014	.05s	.008s	10^6 tons asphalt	1480	118	740	9.6	13.9	11.6	2300
SECONDARY LEAD (Blast Furnace)	.68	lb/ton lead produced	48.0	46.6	.48	.032c	.024s	10^6 tons lead	.148	.036	.055	2.3	3.2	1.8	1400
BYPRODUCT COKE OVEN	.93	lb/ton coke produced	5.7	5.7	5.63	.01s	.028s	10^6 tons coke	75.5	21.1	7.5	200	220	219	900

TABLE 6-3 (Continued)

OXIDES OF SULFUR

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
PETROLEUM REFINERY - (1) (Process Gas Combustion)	.85	lb/10^6 cubic feet	8260	2490 Exist 28.6 New	28.6	.042c	.031s	10^{12} cu. ft.	.23	.07	.12	239	167	167	0
For those cases where there was no demonstrated control technology... **(See P.29)**															
PETROLEUM REFINERY - FCCU	.85	lb/bbl feed	.493	.493	0.0	.042c	.031s	10^6 BBL	1506	467	771	516	477	218	259000
PRIMARY ALUMINUM SMELTER	.92	lb/ton aluminum produced	60.0	56.1	0.0	.075c	.035s	10^6 ton aluminum	6.0	2.1	6.4	154.8	319.1	100.6	218000
BOILER < .3 x 10^6 BTU/HR	.30	lb/10^6 BTU	.107	.107	0.0	.029c	.020s	10^{12}BTU	24572	4914	8131	394	525	316	200000
IRON & STEEL PLANT (Sintering)	.90	lb/ton sinter produced	3.0	3.0	0.0	.029s	.028s	10^6 ton sinter	69.6	19.5	20.2	94	121.2	67.7	53600
GLASS PRODUCTION (Soda Lime Glass)	.80	lb/ton glass produced	4.24	4.24	0.0	.028s	.033s	10^6 tons glass	34.4	11.4	9.6	58.4	74.7	39.1	35600
INDUSTRIAL/COMMERCIAL INCINERATOR	.38	lb/ton waste burned	2.38	2.38	0.0	.11c	.039s	10^6 tons waste	32.6	12.71	59.97	14.7	41.9	9.0	32870
MUNICIPAL INCINERATOR	.56	lb/ton waste burned	3.9	3.9	0.0	.046s	.039s	10^6 tons waste	32.5	12.7	14.9	35.5	51.8	21.6	30200
ORCHARD HEATERS	1.0	lb/ heater-hr.	.037	.037	0.0	.028s	.033s	10^6 heater-hrs.	60.0	19.8	16.8	1.1	1.4	.7	680
GLASS PRODUCTION (Opal Glass)	.80	lb/ton glass produced	4.24	4.24	0.0	.028s	.033s	10^6 tons glass	.5	.3	.1	.8	1.0	.5	510
HYDROFLUORIC ACID	.98	lb/ton 100% acid	2.1	2.1	0.0	.049s	.045s	10^6 tons acid	.45	.20	.22	.463	.689	.257	432
MINERAL WOOL	.82	lb/ton product	.02	.02	0.0	.02s	.029s	10^6 tons product	8.4	2.5	1.7	.07	.08	.05	30

TABLE 6-4

HYDROCARBONS

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industrial Capacity				1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
OPEN BURNING (Agricultural)	1.00	lb/ton waste burned	20.0	20.0	0.0	.009c	0.0	10^6 tons waste	280	0	26.2	2800	3063	0(1)	3062500
INDUSTRIAL SURFACE COATING	.82	lb/gal coating applied	6.55	5.34	.655	.078c	.042s	10^6 gal coating	867	364	971	1898	4025	1460	2560000
AMMONIA (Methanator Plant)	.83	lb/ton ammonia produced	90.0	90.0	.45	.09c	.045s	10^6 tons ammonia	11.1	5.0	15.2	415	982	232	750000
AMMONIA (Regenerator & CO Absorber)	.83	lb/ton ammonia produced	90.0	90.0	.45	.09c	.045s	10^6 tons ammonia	11.1	5.0	15.2	415	982	232	750000
DEGREASING	.82	lb/ton metal cleaned	1.5	1.15	.15	.032c	.042s	10^6 tons metal	1626	683	602	767	1051	524	527000
PETROLEUM REFINERY (Misc. Point Sources)	.85	lb/bbl refinery capacity	.586	.586	.293	.042c	.031s	10^6 bbl capacity	4937	1530	2527	1230	1859	1354	505000
ETHYLENE OXIDE	.87	lb/ton ethylene oxide prod.	392.0	392.0	3.92	.075c	.045s	10^6 tons ethylene oxide	1.7	0.8	1.8	290	598	164	434000
PETROLEUM REFUELING	.85	lb/bbl gasoline	.504	.504	.076	.035c	.031s	10^6 bbl gasoline	2950	4927	1195	632	888	504	384000
CARBON BLACK (Furnace Process)	.77	lb/ton carbon produced	570.0	570.0	.57	.025c	.045s	10^6 tons carbon	2.0	.9	.6	436	558	240	318000
DRYCLEANING	1.00	lb/ton clothes cleaned	258	258	9.0	.018c	.05s	10^6 tons clothes	2.4	1.2	.5	304	364	160	204000
PETROLEUM - SERVICE STATIONS	.85	lb/bbl gasoline	.38	.23	.03	.035c	.031s	10^6 bbl gasoline	2950	915	1195	287	403	229	175000
CHARCOAL	.85	lb/ton charcoal produced	438.0	438.0	4.4	.043c	.045s	10^6 tons charcoal	0.8	0.4	0.4	148	226	83	143000
GRAPHIC ARTS (Gravure)	.88	lb/ton ink consumed	2300.	2300.	2.3	.05c	.045s	10^6 tons ink	.117	.052	.074	118	193	65	128000
GRAPHIC ARTS (Flexography)	.88	lb/ton ink consumed	4800.	4800.	48	.05c	.045s	10^6 tons ink	.051	.023	.032	108	175	60	115000

(1) En was applied to both new and existing capacity

TABLE 6-4 (Continued)

HYDROCARBONS

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
SUGAR CANE (Field Burning)	1.00	lb/acre burned	300.0	300.0	0.0	.015s	0.0	10^6 acres	.6	0	.1	98	112	0(1)	112000
PETROLEUM REFINERY (Vacuum Distillation)	.85	lb/bbl vacuum distillate	.13	.13	.0001	.042c	.031s	10^6 bbl vacuum distillate	1846	572	945	102	154	70	83800
BY-PRODUCT COKE OVENS	.93	lb/ton coke produced	5.9	5.9	.06	.010s	.028s	10^6 tons coke	75.5	21.1	7.5	207	228	150	77900
GRAPHIC ARTS (Letter Press)	.88	lb/ton ink consumed	1500.	1500.	15.0	.05c	.045s	10^6 tons ink	.110	.05	.069	73	118	41	77500
GRAPHIC ARTS (Lithography)	.88	lb/ton ink consumed	2800.	2500.	28.0	.05c	.045s	10^6 tons ink	.063	.028	.040	69	113	39	73900
GRAPHIC ARTS (Metal Decorating)	.88	lb/ton ink consumed	3700.	3200.	37.0	.05c	.045s	10^6 tons ink	.046	.021	.029	65	106	36	69100
ACRYLONITRILE	.90	lb/ton acrylonitrile produced	330.0	91.0	.165	.095c	.045s	10^6 tons acrylonitrile	.8	.4	1.2	34	84	19	65400
CAST IRON FOUNDRY (Core Ovens)	.93	lb/ton metal cast	10.5	10.5	1.05	.035s	.028s	10^6 tons metal	23.0	6.4	8.0	112	152	88	63700
FORMALDEHYDE	.72	lb/ton formaldehyde produced	27.5	22.2	.28	.094c	.045s	10^6 tons formaldehyde	4.2	1.9	6.1	34	83	19	63300
PAINT	.85	lb/ton paint produced	30.0	30.0	0.3	.026c	.067s	10^6 tons paint	4.9	3.3	1.5	63	82	22	60000
BEER	.81	lb/10^3gal beer	10.9	10.9	.109	.070c	.040s	10^9gal beer	7.2	2.9	7.0	32	63	20	43000
AUTOMOBILE ASSEMBLY PLANT	.91	lb/auto produced	21.0	12.6	.42	.029c	.040s	10^6 autos	10.6	4.2	3.5	61	81	38	42900
VEGETABLE OIL	.92	lb/ton oil produced	38.0	37.9	15.2	.027s	.028s	10^6 tons oil	6.5	1.8	1.8	114	144	107	37400
ETHYLENE DICHLORIDE	.62	lb/ton ethylene dichloride produced	140.0	19.6	.140	.090c	.045s	10^6 tons etnylene dichloride	3.3	1.5	4.5	20	48	11	36200

(1) En was applied to both new and existing capacity

TABLE 6-4 (Continued)

HYDROCARBONS

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
PETROLEUM TRANSFER - GASOLINE	.85	lb/bbl gasoline	.116	.071	.012	.035c	.042s	10^6 bbl gasoline	1560	651	632	47	66	34	32400
PETROLEUM STORAGE DISTILLATE OIL (Breathing)	1.00	lb/bbl distillate oil	.593	.431	.286	.032c	.031s	10^6 bbl distillate oil	643	199	238	139	190	158	31700
SYNTHETIC RESIN (Acrylic)	.87	lb/ton resin	240	36	2.4	.154c	.045s	10^6 tons resin	.583	.262	1.86	9.1	38.2	7.2	31000
POLYETHYLENE (Low Density)	.88	lb/ton polyethylene produced	25.0	4.2	.25	.165c	.006s	10^6 tons polyethylene	4.8	.3	17.5	9	41	10	30900
MALEIC ANHYDRIDE (Benzene Oxidation)	1.0	lb/ton maleic anhydride	172	147	.172	.09c	.045s	10^6 tons maleic anhydride	.23	.104	.314	16.9	40	9.3	30700
DIRECT FIRING OF MEATS	.62	lb/unit-yr	6136.	6136.	2636.	.033s	.05s	10^6 units	.0337	.0168	.0111	64	85	55	30300
POLYETHYLENE (High Density)	1.00	lb/ton polyethylene produced	50.0	7.4	.5	.176c	0.0	10^6 tons polyethylene	1.9	0.0	7.6	7.0	35.0	9.0	26300
VARNISH	.85	lb/ton varnish produced	67.9	34.9	.679	.026c	.067s	10^6 tons varnish	1.3	.9	.4	19	25	6.7	18100
PHTHALIC ANHYDRIDE (O-Xylene)	.78	lb/ton phthalic anhydride produced	130.0	86.6	5.0	.079c	.020s	10^6 tons phthalic anhydride	.4	.1	.5	14	30	12	17900
POLYVINYL CHLORIDE	.82	lb/ton PVC produced	17.0	9.6	.09	.078c	.0002s	10^6 tons PVC	2.7	.005	3.1	11	23	11	12000
SYNTHETIC FIBERS (Nylon)	.72	lb/ton nylon produced	7.0	7.0	.35	.127c	.045s	10^6 tons nylon	1.7	.77	4.0	3.1	14.3	3.0	11300
PETROLEUM TRANSFER CRUDE OIL	.85	lb/bbl crude oil	.084	.071	.048	.042c	.029s	10^6 bbl crude oil	1440	418	737	43	66	54	11300
PRINTING INK	.83	lb/ton ink produced	120.0	48.0	12.0	.05c	.045s	10^6 tons ink	.4	.2	.3	8.5	14	7	6900
WOOD PROCESSING (Plywood)	.95	lb/ft^2 wood produced	.001	.001	0.0	.025c	.05s	10^6 ft^2 wood	22600	11300	6330	8	10	4	6200

TABLE 6-4 (Continued)

HYDROCARBONS

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
DEEP FAT FRYING	.81	lb/ton food processed	7.75	6.24	.078	.043c	.028s	10^6 tons food	2.6	.7	1.4	6.7	10.2	4.9	5300
POLYSTYRENE	.88	lb/ton polystyrene produced	11.7	4.2	.12	.075c	.005s	10^6 tons polystyrene	2.3	.10	2.5	4.3	9.0	4.3	4700
PETROLEUM TRANSFER JET FUEL	.85	lb/bbl jet fuel	.116	.09	.054	.094c	.042s	10^6 bbl jet fuel	146	61	213	5.6	13.7	9.5	4200
WOOD PULPING (Kraft Process)	.98	lb/ton pulp produced	4.69	4.69	4.24	.012c	.031s	10^6 tons pulp	34	11	4.3	78	88	85	3300
PETROLEUM REFINERY (Process Gas Combination),	.85	lb/10^3 cu. ft. gas	33.0	33.0	0.0	.042c	.031s	10^{12} cu. ft. gas	.2	.1	.1	3.2	4.8	2.2	2600
INTERNAL COMBUSTION ENGINES (Diesel & Dual Fuel)	.58	lb/hp-yr	31.3	31.3	30.3	.028s	.020s	10^6 hp-yr	18.0	3.6	5.0	163	209	206	2500
SYNTHETIC RESINS (Phenolic)	.80	lb/ton resin produced	7.5	5.76	.075	.07c	.005s	10^6 tons resin	1.1	.05	1.04	2.5	4.8	2.4	2480
ASPHALT ROOFING (Blowing)	.90	lb/ton asphalt input	2.5	2.5	.025	.025s	.042s	10^6 tons asphalt	3.1	1.3	0.8	3.5	4.4	2.1	2400
MINERAL WOOL	.82	lb/ton wool produced	2.02	2.02	.87	.020s	.029s	10^6 tons wool	8.4	2.5	1.7	7.0	8.4	6.4	2000
SYNTHETIC RESINS (Urea - Melamine)	.80	lb/ton resin produced	7.5	5.76	.075	.073c	.005s	10^6 tons resin	.74	.037	.757	1.7	3.45	1.6	1806
PETROLEUM STORAGE KEROSINE (Breathing)	1.00	lb/bbl kerosene	.593	.435	.295	0.0	.031s	10^6 bbl kerosene	76	24	0	17	17	15	1600
WHISKEY	.95	lb/10^3 gal whiskey produced	2.76	2.76	.055	.06s	.032s	10^9 gal whiskey	1.3	.42	.78	1.7	2.7	1.2	1540
FIBERGLASS (Wool Processing)	.70	lb/ton glass produced	3.39	3.39	.102	.042c	.063s	10^6 tons glass	1.1	.7	.6	1.3	1.9	.5	1400
SYNTHETIC RESINS (ABS - SAN)	.80	lb/ton resin produced	7.5	5.76	.075	.072c	.005s	10^6 tons resin	.47	.024	.47	1.1	2.2	1.04	1127
POLYPROPYLENE	.78	lb/ton polypropylene produced	.7	.59	.003	.15c	.003s	10^6 tons polypropylene	1.6	.05	4.9	.4	1.5	.4	1100

TABLE 6-4 (Continued)

HYDROCARBONS

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
SYNTHETIC FIBERS (Acetate)	.93	lb/ton acetate produced	7.0	7.0	.35	.0277c	.045s	10^6 tons acetate	.43	.19	.13	1.4	1.8	.8	1000
PETROLEUM TRANSFER - AVIATION GAS	.85	lb/bbl aviation gas	.116	.090	.055	.094c	.042s	10^6 bbl aviation gas	36	15	52	1.4	3.3	2.4	990
TEXTILE PROCESSING (Heat Setting & Finishing)	.86	lb/ton textiles produced	10.18	3.054	1.486	.081c	.042s	10^6 tons textiles	.8	.3	.9	1.0	2.3	1.4	850
TEXTILE PROCESSING (Carpet Manufacturing)	.86	lb/ton textiles produced	.80	.72	.04	.053c	.042s	10^6 tons textiles	1.8	.8	1.2	.6	1.0	.4	590
COFFEE ROASTING	.85	lb/ton coffee roasted	1.1	1.1	.005	0.0	.040s	10^6 tons coffee	1.5	.6	0	.75	.75	.4	290
STYRENE-BUTADIENE RUBBER	.75	lb/ton rubber produced	4.2	4.2	3.1	.020c	.003s	10^6 tons rubber	2.3	.1	.5	3.6	4.4	4.2	240
AUTOBODY INCINERATION	.90	lb/auto	1.0	1.0	.46	.28s	.039s	10^6 autos	.3	.1	.8	.1	.5	.3	230
LEAD ACID BATTERY PLANT	.76	lb/ battery produced	.009	.0068	.0001	.06c	.04s	10^6 batteries	80	32	50	.2	.3	.1	210
SYNTHETIC RESIN (Alkyd)	.68	lb/ton resin	1.71	1.71	.017	.015c	.045s	10^6 tons resin	.53	.239	.085	.31	.36	.17	187
ZINC - (Sweat Furnace)	.82	lb/ton zinc produced	2.81	2.81	.003	.039c	.035s	10^6 tons zinc	.2	.1	.1	.2	.3	.1	180
MEAT SMOKEHOUSES	.81	lb/ton meat smoked	.35	.35	.15	.017s	.04s	10^6 tons meat	3.6	1.4	.6	.5	.6	.4	170
TEXTILE PROCESSING (Texturizing)	.86	lb/ton textiles produced	4.6	.92	.23	.023c	.042s	10^6 tons textiles	.9	.4	.2	.3	.4	.3	170
PETROLEUM TRANSFER - SPECIAL NAPHTHA	.85	lb/bbl special naphtha	.116	.090	.056	.007c	.042s	10^6 bbl special naphtha	18	7.4	1.3	.7	.7	.6	130

TABLE 6-4 (Continued)

HYDROCARBONS
SUMMARY OF INPUT/OUTPUT VARIABLES
FOR MODEL IV

		Emission Rates				Decimal/Y		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1975	C 1975	Tu 1985	Ts 1985	Tn 1985	Ts-Tn 1985
PATHOLOGICAL INCINERATORS	.34	lb/ton waste	3.8	3.8	.04	.026c	.039s	10^6 tons waste	.13	.05	.04	.1	.11	.05	60
MAGNESIUM SMELTING	.82	lb/ton magnesium produced	3.39	3.39	.003	.016s	.035s	10^6 tons magnesium	.018	.006	.003	.03	Negligible Values		10
PETROLEUM STORAGE (2) AVIATION GAS (Working)	.85	lb/bbl aviation gas	.116	.055 New .090 Exist	.055	.094c	.031s	10^6 bbl aviation gas	67	21	98	2.6	4.5	4.5	0
PETROLEUM STORAGE(2) AVIATION GAS (Breathing)	1.00	lb/bbl aviation gas	2.85	1.35 New 2.06 Exist	1.35	.094c	.031s	10^6 bbl aviation gas	37.0	12.0	54.0	38	71	71	0
PETROLEUM STORAGE(2)- CRUDE OIL (Working)	.85	lb/bbl crude oil	.084	.048 New .071 Exist	.048	.042c	.031s	10^6 bbl crude	6000	1860	3054	181	225	225	0
PETROLEUM STORAGE CRUDE(2) OIL (Breathing)	1.00	lb/bbl crude	2.88	1.56 New 2.29 Exist	1.56	.042c	.031s	10^6 bbl crude	589	183	300	674	842	842	0
PETROLEUM STORAGE(2) GASOLINE (Working)	.85	lb/bbl gasoline	.116	.012 New .071 Exist	.012	.035c	.031s	10^6 bbl gasoline	2950.	915.	1211	89	72	72	0
PETROLEUM STORAGE (2) GASOLINE (Breathing)	1.00	lb/bbl gasoline	2.85	.29 New 1.49 Exist	.29	.035c	.031s	10^6 bbl gasoline	477	148	196	355	294	294	0
PETROLEUM STORAGE JET (2) FUEL (Working)	.85	lb/bbl jet fuel	.116	.054 New .09 Exist	.054	.094c	.031s	10^6 bbl jet fuel	276	86	402	11	19	19	0
PETROLEUM STORAGE JET (2) FUEL (Breathing)	1.00	lb/bbl jet fuel	1.4	.65 New 1.0 Exist	.65	.094c	.031s	10^6 bbl jet fuel	124	38	180	62	114	114	0
PETROLEUM STORAGE SPECIAL(2) NAPHTHA (Working)	.85	lb/bbl special naphtha	.116	.056 New .090 Exist	.056	.007c	.031s	10^6 bbl special naphtha	33	10	2.4	1.3	1.2	1.2	0
PETROLEUM STORAGE SPECIAL(2) NAPHTHA (Breathing)	1.00	lb/bbl special naphtha	2.85	1.30 New 1.34 Exist	1.30	.007c	.031s	10^6 bbl special naphtha	18.2	5.6	1.3	12.2	12.9	12.9	0

(2) $E_{s_{new}}$ based on existing NSPS

TABLE 6-4 (Continued)

HYDROCARBONS

SUMMARY OF INPUT/OUTPUT VARIABLES
FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industry Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
For those cases where there was no demonstrated control technology... (See P.29) INTERNAL COMBUSTION ENGINES (Spark Ignition)	.58	lb/hp-yr	56.0	56.0	0.0	.087s	.020s	10^6 hp-yr	28.7	5.7	25.0	467	873	373	499000
BOILERS> 250 x 10^6 BTU/HR	.58	lb/10^6 BTU	.019	.019	0.0	.055c	.050s	10^{12} BTU	28011	14006	19836	154	264	77	186000
ORCHARD HEATERS	1.00	lb/heater-hr	9.2	9.2	0.0	.028s	.033s	10^6 heater hours	60	19.8	16.8	276	353	185	168000
BOILERS .3-10 x 10^6BTU/HR	.25	lb/10^6 BTU	.042	.042	0.0	.043c	.037s	10^{12} BTU	26471	9794	13857	139	212	88	124000
BOILERS 10-250 x 10^6 BTU/HR	.32	lb/10^6 BTU	.045	.045	0.0	.014c	.050s	10^{12} BTU	19534	9767	2914	141	162	70	91300
INDUSTRIAL/COMMERCIAL INCINERATORS	.38	lb/ton waste burned	2.88	2.88	0.0	.11c	.039s	10^6 tons waste	32.6	12.7	60.0	18	51	11	39800
BOILERS <.3 x 10^6 BTU/Hr	.30	lb/10^6BTU	.019	.019	0.0	.029c	.020s	10^{12} BTU	24572	4914	8131	70	93	56	37200
ASPHALT BATCHING	.47	lb/ton asphalt produced	.167	.167	0.0	.050s	.008s	10^6 tons asphalt	1480	118	740	58	87	53	33700
MUNICIPAL INCINERATORS	.56	lb/ton waste	2.7	2.7	0.0	.046s	.039s	10^6 tons	32.5	12.7	14.9	24.6	35.9	15.0	20900
BRICK & RELATED CLAY PRODUCTS	.80	lb/ton clay produced	.073	.073	0.0	.027s	.033s	10^6 tons clay	35.7	11.8	9.6	1.0	1.3	.7	620

TABLE 6-5

CARBON MONOXIDE

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
OPEN BURNING (Agricultural)	1.00	lb/ton waste burned	100.0	100.0	0.000	.009c	.000	10^6 tons waste	280.0	0.0	26.2	14000	15512	$0^{(1)}$	15512000
IRON & STEEL PLANT (BOF)	.90	lb/ton steel produced	139.0	139.0	3.000	.046s	.028s	10^6 tons steel	68.9	24.9	42.7	5560.7	8229.8	4094.9	4130000
CARBON BLACK (Furnace Process)	.77	lb/ton carbon black produced	4500.0	4500.0	4.5	.025c	.045s	10^6 tons carbon black	2.0	0.9	0.6	3443	4407	1896	2510000
AMMONIA - (Regenerator & CO absorber)	.83	lb/ton ammonia produced	200.0	200.0	1.0	.090c	.045s	10^6 tons ammonia	11.1	5.0	15.2	921	2181	515	1670000
SUGAR CANE -- (Field Burning)	1.00	lb/acre burned	1500.0	1500.0	0.0	.015s	.000	10^6 acres	.6	0	.1	488	561	$0^{(1)}$	561000
WOOD PULPING -- (Kraft Process)	.98	lb/ton pulp	70	70	5.0	.012c	.051s	10^6 tons pulp	33.9	10.5	4.29	1163	1310	839	471000
STATIONARY GAS TURBINES (Electric Utility)	.22	lb/hp-yr	38.6	38.6	12.7	.270s	.020s	10^6 hp-yr.	54.1	10.8	146.1	230	850	403	446000
FORMALDEHYDE	.72	lb/ton formaldehyde produced	135.0	135.0	1.35	.095c	.045s	10^6 tons formaldehyde	4.2	1.9	6.1	206	502	116	386000
MALEIC ANHYDRIDE (Benzene Oxidation)	1.0	lb/ton maleic anhydride	1340	1340	1.34	.09c	.045s	10^6 tons maleic anhydride	.23	.104	.314	154	365	85	279800
ACRYLONITRILE	.90	lb/ton acrylonitrile produced	360.0	360.0	.18	.085c	.045s	10^6 tons acrylonitrile	0.8	0.4	1.2	155	333	74	259000
IRON & STEEL PLANT (Electric Arc Furnace)	.90	lb/ton steel produced	18.0	18.0	4.5	.073s	.028s	10^6 tons steel	36.7	10.3	26.8	297.3	514.3	289.1	225000
INTERNAL COMBUSTION ENGINES (Diesel and Dual Fuel)	.58	lb/hp-yr	54.8	54.8	0.0	.028s	.020s	10^6 hp-yr.	18.0	3.6	5.0	285	365	228	137000
CHARCOAL	.85	lb/ton charcoal produced	320.0	320.0	3.20	.043c	.045s	10^6 tons charcoal	0.8	0.4	0.4	108.1	164.7	60.5	104000
PHTHALIC ANHYDRIDE (O-xylene Process)	.78	lb/ton phthalic anydride pro.	280.0	280.0	.200	.079c	.020s	10^6 tons phthalic anydride	.4	.1	.5	46	98	37	61200

(1) En was applied to both new and existing capacity

TABLE 6-5 (Continued)

CARBON MONOXIDE

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
STATIONARY GAS TURBINES (Gas Pipeline)	.85	lb/hp-yr	29.4	29.4	9.69	.145s	.020s	10^6 hp-yr	4.4	.9	6.4	54.9	134	73.7	[illegible]
IRON & STEEL PLANT (Blast Furnace)	.90	lb/ton pig iron used	1.75	1.75	0.00	.029s	.028s	10^6 tons pig iron	118.7	33.2	34.4	93.5	120.6	67.3	53280
FERROALLOY	.90	lb/ton **ferroalloy** produced	136.0	136.0	1.40	.015c	.028c	10^6 tons **ferro-alloy**	1.6	0.4	0.3	96.5	110.8	69.2	41600
ETHYLENE DICHLORIDE	.62	lb/ton Ethylene Dichloride	16.0	16.0	.016	.090c	.045s	10^6 tons Ethylene Dichloride	3.3	1.5	4.5	16.4	38.7	9.0	29700
SECONDARY LEAD (Blast Furnaces)	.68	lb/ton lead produced	207.0	207.0	12.9	.032c	.024s	10^6 tons lead	.148	.036	.065	10.4	14.3	8.3	6000
ASPHALT ROOFING - (Blowing)	.90	lb/ton Asphalt Input	1.50	1.50	.015	.025s	.042s	10^6 tons Asphalt	3.1	1.3	0.8	2.1	2.7	1.2	1400
FIBERGLASS (Textile Processing)	.70	lb/ton Textiles Produced	3.50	3.50	1.55	.122c	.063s	10^6 tons Textiles	0.5	0.3	1.1	0.6	2.0	1.0	990
PATHOLOGICAL INCINERATOR	.34	lb/ton waste	4.1	4.1	.04	.026c	.039s	10^6 tons waste	.13	.05	.04	.09	.12	.06	60
FIBERGLASS (Wool Processing)	.70	lb/ton wool produced	2.08	2.08	1.95	.042c	.063s	10^6 tons wool	1.1	0.7	0.6	0.8	1.2	1.1	60
SECONDARY ZINC (Sweat Furnace)	.82	lb/ton zinc produced	.012	.012	.000	.039c	.035s	10^6 tons zinc	0.2	0.1	0.1	Negligible Values			1
MAGNESIUM SMELTING	.82	lb/ton Magnesium produced	.058	.058	.000	.016s	.035s	10^6 tons Magnesium	.0175	.006	.003	Negligible Values			5
PETROLEUM REFINERY FCCU	.85	lb/BBL Feed	13.70	13.70 Exist .068 New	.068	.042c	.031s	10^6 BBL Feed	1506	467	771	8770	6085	6085	0
For those cases where there was no demonstrated control technology... **(See P.29)** IRON & STEEL PLANT (Sintering)	.90	lb/ton sinter processed	44.0	44.0	0.0	.029s	.028s	10^6 tons sinter	69.6	19.5	20.2	1378.1	1777.7	992.2	786000

TABLE 6-5 (Continued)

CARBON MONOXIDE

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rate Decimal/Year		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Es	En	Pc	Pb	Units/Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tn 1985	Ts-Tn 1985
INTERNAL COMBUSTION ENGINES (Spark Ignition)	**.58**	lb/hp-yr	**42.8**	**42.8**	**0.0**	**.087s**	**.020s**	10^6 **hp-yr**	**28.7**	**5.7**	**25.0**	**357**	**667**	**285**	**381000**
MUNICIPAL INCINERATION	.56	lb/ton refuse	34.8	34.8	0.0	.046s	.039s	10^6 tons refuse	32.5	12.7	14.9	317	462	193	269000
BOILERS > 250 x 10^6 BTU/hr	.58	lb/10^6 BTU	.024	.024	0.0	.055c	.050s	10^{12}BTU	28011	14006	19836	195	333	97	236000
BOILERS 10-250 x 10^6 BTU/hr	.32	lb/10^6 BTU	.110	.110	0.0	.014c	.050s	10^{12}BTU	19534	9767	2914	344	395	172	223000
MINERAL WOOL	.82	lb/ton wool produced	94.4	94.4	0.00	.020s	.029s	10^6 tons wool	8.4	2.5	1.7	326.6	391.9	230.6	161000
BOILERS 0.3 - 10 x 10^6 BTU/hr	.25	lb/10^6 BTU	.051	.051	0.0	.043c	.037s	10^{12}BTU	26471	9794	13857	169	257	106	151000
INDUSTRIAL/COMMERCIAL INCINERATORS	.38	lb/ton waste processed	8.97	8.97	0.0	.110c	.039s	10^6 tons waste	32.6	12.71	59.97	55.6	157.8	33.9	123900
BOILERS < 0.3 x 10^6 BTU/hr	.30	lb/10^6BTU	.026	.026	0.0	.029c	.020s	10^{12} BTU	24572	4914	8131	96	128	77	50900
BY-PRODUCT COKE OVENS	.93	lb/ton coke produced	1.70	1.70	0.0	.010s	.028s	10^6 tons coke	75.5	21.1	7.5	60	66	43	22700
BRICK & RELATED CLAY PRODUCTS	.80	lb/ton clay	0.155	0.155	0.0	.027s	.033s	10^6 tons clay	35.7	11.8	9.6	2.2	2.8	1.5	1300
AUTO BODY INCINERATORS	.90	lb/car burned	2.50	2.50	0.0	.280s	.039s	10^6cars	.3	.1	.8	.3	1.3	.2	1100
CHLOR - ALKALI (Diaphragm Cell)	.95	lb/ton chlorine produced	.158	.158	0.0	.065c	.045s	10^6 tons chlorine	9.7	4.4	8.5	.7	1.4	.4	970
SMOKED MEAT	.81	lb/ton meat smoked	.600	.600	0.0	.017s	.040s	10^6 tons meat smoked	3.6	1.4	.6	.9	1.0	.5	500
CHLOR - ALKALI (Mercury Cell)	.95	lb/ton chlorine produced	.158	.158	0.0	.065c	.045s	10^6tons chlorine	3.7	1.7	3.3	.3	.5	.2	370
ORCHARD HEATERS	1.00	lbs/heater-hr.	.004	.004	.000	.028s	.033s	10^6 heater-hr	60.0	19.8	16.8	0.1	0.2	0.1	70

(1) En was applied to both new and exisiting capacity

TABLE 6-6

FLUORIDES

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates					Growth Rates Decimal/yr.		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	E111d	Es	En	Pc	Pb	Units/Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tnd 1985	Ts-Tnd 1985
PRIMARY ALUMINUM SMELTERS	.92	lb/ton aluminum produced	46.0	3.0	19.0	2.0	.075c	.035s	10^6 tons aluminum	6.00	2.1	6.37	52.4	108.1	13.2	94900
BOILERS >250 x 10^6 BTU/HR	.58	lb/10^6BTU	.00382	.00382	.00382	.0024	.055c	.05s	10^{12}BTU	28011	14006	19836	31.0	53.0	17.84	35159
HYDROFLUORIC ACID	.98	lb/ton 100% HF produced	71.4	.29	71.4	.29	.049s	.045s	10^6 tons 100% HF	.45	.20	.22	15.7	23.4	.10	23300
BRICK AND RELATED CLAY PRODUCTS	.80	lb/ton clay product produced	1.0	.30	1.0	.30	.027s	.033s	10^6 tons clay product	35.7	11.8	9.6	14.3	18.1	2.6	15550
BOILERS 10 -250 x 10^6 BTU/HR	.32	lb/10^6BTU	.00322	.000464	.000322	.00064	.014c	.05s	10^{12}BTU	19534	9767	2914	1.01	11.57	1.63	9934
CERAMIC CLAY	.80	lb/ton clay product produced	1.0	.30	1.0	.30	.042s	.033s	10^6 tons clay product	13.9	4.6	5.8	4.45	7.9	2.4	5520
FIBERGLAS - (Textile Process)	.70	lb/ton glass produced	8.15	.082	8.15	.02	.122c	.063s	10^6 tons glass	.5	.3	1.1	1.43	4.68	.016	4664
GLASS - (Opal Glass)	.80	lb/ton glass produced	22.1	4.42	22.1	4.42	.028s	.033s	10^6 tons glass	.456	.15	.128	4.03	5.16	1.03	4127
BOILERS 0.3 - 10 x 10^6 BTU/HR	.25	lb/10^6 BTU	.00081	.000216	.000806	.00216	.043c	.037s	10^{12} BTU	26471	9794	13857	2.67	4.06	1.09	2974
FRIT MANUFACTURING	.80	lb/ton frit produced	5.56	.334	5.56	.334	.037s	.033s	10^6 tons frit	.837	.276	.310	1.86	2.55	.153	2398
ANIMAL FEED DEFLUORINATION	.90	lb/ton P_2O_5 produced	219.0	.44	59.4	.44	0.0	.04s	10^6 tons P_2O_5	.200	.08	0	5.35	5.35	3.22	2123
IRON AND STEEL PLANT (Open Hearth Furnace)	.90	lb/ton pig iron produced	.102	.005	.102	N.A.	-.036 s	0	10^6 tons pig iron	48.9	0	-17.6	2.24	1.44	.07	1367
NORMAL SUPERPHOSPHATE	.76	lb/ton $P_2 O_5$ produced	6.9	.50	3.1	N.A.	-.075 c	0	10^6 tons $P_2 O_5$	.844	0	-.45	.99	.47	.076	394
IRON AND STEEL PLANTS (Electric Arc Furnace)	.90	lb/ton raw steel produced	.069	.0044	.021 exist .0134 new	.0044	.073s	.028s	10^6 tons raw steel	36.7	10.3	26.8	.35	.473	.126	347
CASTABLE REFRACTORIES	.80	lb/ton refractory produced	1.3	.065	1.3	.065	.043c	.033s	10^6 tons refractory	.39	.13	.20	.203	.306	.015	290
PHOSPHORIC ACID (Wet Process)	.81	lb/ton P_2O_5 produced	2.5	.0217	.0339	.0108	.10c	.045s	10^6 tons P_2O_5	9.14	4.11	14.57	.125	.326	.126	200
DIAMMONIUM PHOSPHATE FERTILIZER	.89	lb/ton P_2O_5 produced	.29	.06	.12	.06	.054s	.045s	10^6 tons P_2O_5	3.14	1.41	1.70	.167	.263	.129	134

TABLE 6-6 (Continued)

FLUORIDES

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

			Emission Rates				Growth Rates Decimal/yr		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Ellld	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tnd 1985	Ts-Tnd 1985
GRANULATED TRIPLE SUPERPHOSPHATE (Production)	.76	lb/ton P_2O_5 produced	.60	.20	.27	.12	.042c	.045s	10^6 tons P_2O_5	1.18	.53	.60	.121	.184	.101	83
FIBERGLAS - (Wool Processed)	.70	lb/ton glass produced	.08	.001	.08	.02	.042c	.063s	10^6 tons glass	1.10	.70	.60	.031	.046	.010	36
ROP TRIPLE SUPERPHOSPHATE	.76	lb/ton P_2O_5 produced	1.0	.20	.50	N.A.	-.056 c	0	10^6 tons P_2O_5	.525	0	-.225	.10	.057	.023	34
GRANULATED TRIPLE SUPERPHOSPHATE (Storage)	.76	lb/ton P_2O_5 produced	.026	.012	.026	.012	.042c	.045s	10^6 tons P_2O_5	1.18	.53	.60	.011	.018	.008	9.5
SUPERPHOSPHORIC ACID (Submerged Combustion)	.71	lb/ton P_2O_5 produced	17.5	.01	.069	N.A.	0	0	10^6 tons P_2O_5	.156	0	0	.0038	.0038	.00055	3.3
SUPERPHOSPHORIC ACID (Vacuum Evaporation)	.71	lb/ton P_2O_5 produced	.005	.0009	.005	.0009	.085c	.045s	10^6 tons P_2O_5	.694	.312	.875	.001	.003	.0005	2.3
IRON AND STEEL PLANTS (BOF)[(1)]	.90	lb/ton raw steel produced	.049	.00015	.0002 exist .00015 new	.00015	.048s	.028s	10^6 tons raw steel	88.9	24.9	42.7	.008	.010	.009	1

(1) $E_{s_{new}}$ based on Existing NSPS for Particulates

TABLE 6-7

HAZARDOUS POLLUTANTS[1,2]

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates					Growth Rates Decimal/yr.		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	E112	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Tn 1975	Ts 1985	Tnd 1985	Ts-Tnd 1985
PESTICIDES	.83	lb/ton pesticides produced	10.0	.100	10.0	.100	.074c	.045s	10^6 tons pesticides	1.067	.480	1.112	4.428	9.045	.0904	8953
PHARMACEUTICALS	.83	lb. mercury/ ton pharmaceuticals produced	.229	.046	.229	.046	.09c	.045s	10^6 tons pharmaceuticals	.24	.108	.328	.0228	.054	.011	43
COTTON GINNING	1.00	lb/bale cotton	.0036	.00014	.00063	.00014	.013c	.042s	10^6 bales cotton	10.8	4.5	1.4	.0034	.0038	.0008	3
CHLOR-ALKALI (Mercury Cell)	.95	lb. mercury ton chlorine produced	.62	.005	.006	.005	.065c	.045s	10^6 tons chlorine	3.74	1.68	3.28	.0089	.0199	.0176	2

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[1] Several source categories emitting hazardous pollutants are included within Table 6-13 "TRACE METALS"

[2] More dangerous to human health than what is commonly termed "particulate matter"

TABLE 6-8

ACID MIST

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates					Growth Rates Decimal/yr.		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Ellld	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tnd 1985	Ts-Tnd 1985
CERAMIC CLAY	.80	lb/ton clay produced	19.2	.634	19.2	.634	.042s	.035s	10^6 tons clay	13.9	4.6	5.8	106.8	151.3	5.0	146300
SECONDARY ALUMINUM (Reverb Furnace)	.82	lb/ton aluminum produced	151.6	.152	151.6	.152	.0466c	.036s	10^6 tons aluminum	1.4	.5	.7	87.0	130.1	.130	130000
SULFURIC ACID[(1)]	.84	lb/ton 100% H_2SO_4	2.3	.15	1.68 exist. .15 new	.10	.053c	.045s	10^6 tons 100% H_2SO_4	48.8	21.96	33.0	34.4	15.48	4.0	11480
HYDROCHLORIC ACID (Byproduct)	.86	lb/ton 100% HCl produced	3.0	.50	3.0	.10	.068c	.045s	10^6 tons 100% acid	2.63	1.18	2.45	3.39	6.55	.47	6085
LEAD ACID BATTERY	.76	lb/battery produced	.04	4E-6	.04	4E-6	.05c	.04s	10^6 batteries	80.0	32.0	50.3	1.22	1.98	negli-gible	1980
HYDROCHLORIC ACID (Salt)	.86	lb/ton 100% HCL produced	2.55	.50	2.55	.10	.068c	.045s	10^6 tons 100% HCl	.26	.12	.24	.29	.55	.045	502
SUPERPHOSPHORIC ACID (Submerged Combustion)	.71	lb/ton P_2O_5	.33	.002	.33	N.A.	0	0	10^6 tons P_2O_5	.156	0	0	.0183	.0183	.00011	18

(1) $E_{s_{new}}$ based on existing NSPS

TABLE 6-9

LEAD

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

			Emission Rates				Growth Rates Decima/year		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr.
CATEGORY	K	Units	Eu	E111d	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tnd 1985	Ts-Tnd 1985
COMBUSTION OF WASTE CRANKCASE OIL	.58	lb/gallon oil burned	.075	.0075	.038	.00075	.009c	0	10^6 gallons oil	629	0	59	6.9	7.6	1.4	6200
SECONDARY LEAD (1) (Reverbatory Furnace)	.68	lb/ton lead produced	175.0	.66	4.06 Exist .79 New	.66	.032c	.024s	10^6 tons lead	.713	.171	.264	.984	.865	.219	646
GASOLINE ADDITIVES (Sodium Lead Alloy)	.62	lb/ton lead in product	88.2	3.96	10.78	N.A.	-.117c	0	10^6 tons lead	.283	0	-.195	.945	.294	.108	186
TYPE METAL PRODUCTION	1.0	lb/ton lead produced	77.3	15.5	38.8	N.A.	-.06s	0	10^6 tons lead	.016	0	-.0096	.310	.124	.050	75
SECONDARY LEAD (1) (Blast Furnace)	.68	lb/ton lead produced	171.0	.66	2.74 Exist .79 New	.66	.032c	.024s	10^6 tons lead	.148	.036	.055	.138	.104	.046	58
LEAD PIGMENT	.83	lb/ton lead produced	9.5	.0095	3.12	N.A.	-.075c	0	10^6 tons lead	.0717	0	-.038	.093	.044	.0001	44
MINING & MILLING OF LEAD	.92	lb/ton lead mined	.20	.10	.20	.10	0	.05s	10^6 tons lead	.622	.311	0	.057	.057	.0286	29
PRIMARY LEAD SMELTERS	.85 Ex. .99 New	lb/ton lead produced	37.0	.056	.14	.056	0	.036s	10^6 tons lead	.765	.275	0	.046	.048	.019	29
SECONDARY LEAD (Pot Furnace)	.68	lb/ton lead produced	.857	.026	.86	.026	.032c	.024s	10^6 tons lead	.065	.016	.024	.019	.026	.0008	25
BRASS AND BRONZE (1) SMELTING	.80	lb/ton brass and bronze produced	4.6	.018	.21 Exist .078 New	.018	0	.036s	10^6 tons brass & bronze	.375	.135	0	.032	.0244	.0027	22
CAN MANUFACTURING	.81	lb/ton lead in product	7.1	1.78	3.92	N.A.	-.085c	0	10^6 tons lead	.0555	0	-.032	.088	.0377	.0171	21
FERROALLOY	.90	lb/ton ferroalloy produced	.34	.0034	.017	.0034	.015c	.028s	10^6 tons ferroalloy	1.56	.44	.25	.012	.014	.003	11
CABLE COVER PRODUCTION	10.0	lb/ton lead produced	.0439	.0109	.0439	N.A.	-.043c	0	10^6 tons lead	.0444	0	-.016	.0097	.0063	.0016	4.8
GASOLINE ADDITIVES (Electrolytic)	.62	lb/ton lead in product	33.2	2.31	4.1	N.A.	-.117c	0	10^6 tons lead	.025	0	-.017	.032	.0099	.0055	4.3
For those cases where there was no demonstrated control technology... (See P.29) LEAD ACID BATTERY PLANTS	.76	lb/battery produced	.005	0.0	.005	0.0	.05c	.04s	10^6 batteries	80	32	50.3	.152	.25	0	250

(1) $E_{s_{new}}$ based on existing NSPS for particulate

TABLE 6-10

AMMONIA

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

			Emission Rates				Growth Rates Decimal/yr.		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	EIIId	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tnd 1985	Ts-Tnd 1985
AMMONIA (Regenerator and CO-absorber Plant)	.83	lb/ton ammonia produced	210.0	2.07	210.0	2.07	.09c	.045s	10^6 tons ammonia	11.1	5.0	15.18	967.4	2290	22.58	2267000
AMMONIA (Methanator Plant)	.83	lb/ton ammonia produced	205.0	2.05	205.0	2.05	.09c	.045s	10^6 tons ammonia	11.1	5.0	15.18	935.1	2214	22.14	2192000
PETROLEUM REFINERY - FCCU	.85	lb/bbl feed	.054	.0011	.054	.0011	.0422c	.051s	10^6 bbl feed	1506.0	467.0	771.0	34.56	52.26	1.06	51200
DIAMMONIUM PHOSPHATE FERTILIZER	.89	lb/ton P_2O_5 produced	8.0	.08	8.0	.08	.064s	.045s	10^6 tons P_2O_5	3.14	1.41	1.70	11.2	17.2	.172	17058
NITRATE FERTILIZER	.77	lb/ton fertilizer produced	2.06	.041	2.06	.041	.07c	.045s	10^6 tons fertilizer	10.51	4.73	10.16	8.34	16.4	.326	16067
BY-PRODUCT COKE OVEN	.93	lb/ton coke produced	.26	.002	.26	.002	.01s	.028s	10^6 tons coke	75.5	21.1	7.55	9.1	10.0	.08	9960
SODIUM CARBONATE (Solvay Process)	.89	lb/ton soda ash	7.0	3.5	7.0	N.A.	0	0	10^6 tons soda ash	5.0	0	0	15.6	15.6	7.8	7790
PETROLEUM REFINERY TCCU/HCCU	.85	lb/bbl feed	.006	.001	.006	N.A.	0	0	10^6 bbl feed	234.4	0	0	.598	.598	.01	588
For those cases where there was no demonstrated control technology... (See P.29)																
BEEHIVE COKE OVEN	.93	lb/ton coke produced	3.4	0	3.4	N.A.	0	0	10^6 tons coke	.5	0	0	.79	.79	0	790

TABLE 6-11

SULFIDES

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

			Emission Rates				Growth Rates Decimal/yr.		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	E111d	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tnd 1985	Ts-Tnd 1985
BY-PRODUCT COKE OVEN	.93	lb/ton coke produced	9.4	4.7	9.4	4.7	.01s	.028s	10^6 tons coke	75.5	21.1	7.55	330.0	363.0	182	181000
REFINERY FUEL GAS - SULFUR RECOVERY	.66	lb/ton sulfur input	130.0	0.0	66.6	0.0	.042c	.03s	10^6 tons sulfur	3.57	1.07	1.82	78.0	118.4	0.0	118461
WOOD PULPING - KRAFT	.98	lb/ton pulp produced	18.8	10.0	12.7	1.29	.012c	.031s	10^6 tons pulp	33.9	10.5	4.29	210.9	237.7	124.0	113700
CRUDE OIL AND NATURAL GAS PRODUCTION - SULFUR RECOVERY	.50	lb/ton sulfur input	81.0	0.0	63.0	0.0	.042c	.035s	10^6 tons sulfur	2.87	1.00	1.46	45.0	68.2	0.0	68198
CARBON BLACK (Furnace Process)	.77	lb/ton carbon produced	33.0	.033	33.0	.033	.025c	.045s	10^6 tons carbon	1.99	.89	.56	25.0	32.4	.032	32328
FUEL CONVERSION - COAL GASIFICATION (Low BTU Gas)	.5	lb/10^6 BTU gas produced	.074	NA	.074	.0016	NA	0.0	10^{12} BTU	0	0	1520	0	28.1	.61	27500
SYNTHETIC FIBERS - VISCOSE RAYON	.90	lb/ton rayon produced	55.0	8.3	55.0	8.3	.012s	.045s	10^6 tons rayon	.645	.29	.077	15.9	17.9	2.7	15173
FUEL CONVERSION - COAL GASIFICATION (High BTU gas)	1.0	lb/10^6 BTU gas produced	.039	NA	.039	.0167	NA	0.0	10^{12} BTU	0	0	1100	0	21.5	9.14	12300
FISH PROCESSING -(Fish Meal Cookers and Dryers)	.81	lb/ton meal produced	.058	.0006	.058	.0006	0.0	.008s	10^6 tons meal	.361	.029	0.0	.008	.008	.00009	8
For those cases where there was no demonstrated control technology... (See P.29) BEEHIVE COKE OVEN	.93	lb/ton coke produced	11.2	0	11.2	0	0	0	10^6 tons coke	.5	0	0	2.6	2.6	0	2600

TABLE 6-12

CHLORINE

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates				Growth Rates Decimal/Yr.		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	Ellld	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tnd 1985	Ts-Tnd 1985
CHLOR-ALKALI (Diaphragm Cell)	.95	lb/ton chlorine produced	77.0	.01	77.0	.01	.065c	.045s	10^6 tons chlorine	9.70	4.37	8.51	354.8	666.0	.09	665900
CHLOR-ALKALI (Mercury Cell)	.95	lb/ton chlorine produced	117.0	.01	117.0	.01	.065c	.045s	10^6 tons chlorine	3.74	1.68	3.28	207.9	390.1	.05	390100
SECONDARY ALUMINUM (Reverb Furnace)	.82	lb/ton aluminum produced	76.8	.077	76.8	.077	.0466c	.036s	10^6 tons aluminum	1.4	.5	.7	44.1	65.9	.066	65834
MUNICIPAL INCINERATION	.56	lb/ton waste burned	2.75	.14	2.75	.14	.046s	.039s	10^6 tons waste	32.5	12.68	14.95	25.0	36.5	1.86	34700

TABLE 6-13

TRACE METALS (2)

SUMMARY OF INPUT/OUTPUT VARIABLES FOR MODEL IV

		Emission Rates					Growth Rates Decimal/yr.		Industrial Capacity				Emissions 1000 Ton/Yr			Impact Ton/Yr
CATEGORY	K	Units	Eu	EIIId	Es	En	Pc	Pb	Units/ Year	A 1975	B 1985	C 1985	Ta 1975	Ts 1985	Tnd 1985	Ts-Tnd 1985
BOILERS .3-10 x 10^6 BTU/HR	.25	lb/10^6 BTU	.00224	.00043	.00224	.00043	.043c	.037s	10^{12} BTU	26471	9794	13857	7.41	11.29	2.17	9124
IRON AND STEEL PLANT (Electric Arc Furnace)	.90	lb/ton raw steel produced	1.67	.028	.265 exist. .059 new	.028	.073c	.028s	10^6 tons raw steel	36.7	10.3	26.8	4.38	4.14	.80	3335
BOILERS 10 -250 x 10^6 BTU/HR	.32	lb/10^6 BTU	.00278	.00018	.00053 exist. .00046 new	.00018	.014c	.05s	10^{12} BTU	19534	9767	2914	1.66	1.76	.647	1116
PETROLEUM REFINERY - FCCU	.85	lb/bbl feed	.0312	.0013	.0022	.0013	.0422c	.031s	10^6 bbl	1506	467	771	1.41	2.13	1.26	870
FRIT MANUFACTURING	.80	lb/ton frit produced	1.37	.082	1.374	.082	.037s	.033s	10^6 tons frit	.837	.276	.310	.460	.630	.038	592
BOILERS $>$250 x 10^6 BTU/HR(1)	.58	lb/10^6 BTU	.00267	.00024	.00024 exist. .00012 new	.00012	.055c	.05s	10^{12} BTU	28011	14006	19836	1.95	1.86	1.37	491
BRASS AND BRONZE SMELTING(1)	.80	lb/ton brass & bronze produced	42.7	.17	1.98 exist. .73 new	.17	0.0	.036s	10^6 tons brass & bronze	.375	.135	0.0	.297	.230	.0255	205
PETROLEUM REFINERY - TCCU/HCCU	.85	lb/bbl feed	.0022	.00015	.0022	N.A.	0	0	10^6 bbl feed	234.4	0	0	.219	.219	.015	204
SLUDGE INCINERATORS(1)	.50	lb/ton dry solid feed	24.0	.26	1.0 exist. .26 new	.26	.25s	.033s	10^6 tons dry solid	1.176	.388	2.94	.294	.414	.268	146
IRON AND STEEL PLANT (Open Hearth Furnace)	.9	lb/ton pig iron produced	.275	.014	.018	N.A.	-.036 s	0	10^6 tons pig iron	48.9	0	-17.6	.396	.254	.197	57
IRON AND STEEL PLANT(1) (BOF)	.90	lb/ton raw steel produced	1.26	.0038	.0051 exist. .0038 new	.0038	.048s	.028s	10^6 tons raw steel	88.9	24.9	42.7	.204	.262	.225	37
PATHOLOGICAL INCINERATORS	.34	lb/ton waste	.545	.082	.196 exist. .162 new	.082	.026c	.039s	10^6 tons waste	.1302	.0508	.0381	.0043	.0051	.0024	3
IRON AND STEEL PLANT (Blast Furnace)	.90	lb/ton pig iron produced	2.63	.026	.026	.026	.029s	.028s	10^6 tons pig iron	118.7	33.2	34.4	1.39	1.79	1.79	0
For those cases where there was no demonstrated control technology... (See P.29) BOILERS $<$.3 x 10^6 BTU/HR	.30	lb/10^6 BTU	.00195	0.0	.00195	0.0	.029c	.020s	10^{12} BTU	24572	4914	8131	7.19	9.566	0.0	9566

(1) $E_{s_{new}}$ based on existing NSPS for particulate

(2) Includes As, Be, Cd, Mn, Hg, Ni and V

TABLE 6-14

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM STATIONARY COMBUSTION SOURCES IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Particulate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
BOILER, FOSSIL FUEL														
< 0.5 x 10^6 BTU/hr	76300*	80000*	209000*	37200*	50900*								9566*	
0.5-10 x 10^6 BTU/hr	597000	56200	1670000	124000*	151000*	2974							9124	2335298
10-250 x 10^6 BTU/hr	420581	553884	2566300	91300*	223000*	9934							1116	3551815
> 250 x 10^6 BTU/hr	490000	1040900	8351900	186000*	236000*	35159							491	9918450
Mixed Fuel														
Coal & Refuse	10500	156000	119000											285500
Oil & Refuse	7200	2200	29600											39000
Wood Waste	80800													80800
SUBTOTAL	1606081	1809184	12736800			48067							10731	16210863
ENGINES, STATIONARY														
Gas Turbines'														
Electric Utility	64500*	1060000	122000		446000									1628000
Pipe Line	3600*	158000	2700		60600									221300
Internal Combustion														
Spark Ignition (Heavy Duty Gas Fired)		882000		499000*	381000*									882000
Diesel and Dual Fuel	2000	140000	6200	2500	137000									287700
SUBTOTAL	2000	2240000	130900	2500	643600									3019000
INCINERATORS														
Auto Body	600	30		230	1100*									860
Conical	---- Source characterized by decreasing capacity and zero replacement rate---													
Industrial/Commercial	88450	16850	32870*	39800*	123900*									105300
Municipal	3700	14700	30200*	20900*	269000*							34700		53100
Pathological	29	380*		60	60								3	152
Sludge	0												146	146
SUBTOTAL	92779	31580		290	60							34700	149	159558

TABLE 6-14 (Continued)

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM STATIONARY COMBUSTION SOURCES IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Particulate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
MISCELLANEOUS COMBUSTION														
Open Burning														
Commercial/Industrial	----	Source characterized by decreasing capacity and zero replacement rate---												
Agricultural (1)	2603100	306200		3062500	15312300									21284100
Orchard Heaters	130*		680*	168000*	70*									
Combustion of Waste Crankcase Oil									6200					6200
SUBTOTAL	2603100	306200		3062500	15312300				6200					21290300
TOTAL	4303960	4386964	12867700	3065290	15955960	48067			6200			34700	10880	40679821

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*A case for which there was no demonstrated control technology. This value was not included in any subtotal or total

(1) En was applied to both new and existing capacity

TABLE 6-15

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE CHEMICAL PROCESS INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Parti-culate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
ACIDS														
Adipic		3900												3900
DMT/TPA (Nitric Acid Oxid)		2790												2790
Hydrochloric														
By-product								6085						6085
Salt								502						502
Hydrofluoric	0		432*			23300								23300
Nitric		8100												8100
Phosphoric														
Wet Process						200								200
Thermal Process	721													721
Sulfuric			23100					11480						34580
SUBTOTAL	721	14790	23100			23500		18067						80178
ACRYLONITRILE				65400	259000									324400
AMMONIA														
Methanator Plant				750000						2192000				2942000
Regenerator & CO-absorber Plant				750000	1670000					2267000				4687000
CARBON BLACK														
Channel Process	----Source characterized by decreasing capacity and zero replacement rate----													
Furnace Process	500			318000	2510000						32328			2860828
CHARCOAL	5300			143000	104000									252300
CHLOR-ALKALI														
Diaphragm Cells					970*							665900		665900
Mercury Cells					370*		2					390100		390102
CRUDE OIL & NG PRODUCTION - SULFUR RECOVERY			9900								68198			78098
DETERGENT	490													490
ESSENTIAL OILS														
ETHYLENE DICHLORIDE (Oxychlorination Process)				36200	29700									65900

TABLE 6-15 (Continued)

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE CHEMICAL PROCESS INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Particulate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
ETHYLENE OXIDE				434000										434000
EXPLOSIVES														
High	290	229000	41400											270690
Low		15800	24500											40300
FORMALDEHYDE				63300	386000									449300
FUEL CONVERSION - COAL GASIFICATION														
High BTU Gas											12300			12300
Low BTU Gas											27500			27500
LEAD PIGMENT [1]									44					44
MALEIC ANHYDRIDE				30700	279800									310500
PAINT	2000			60000										62000
PHTHALIC ANHYDRIDE														
Naphthalene	----Source characterized by decreasing capacity and zero replacement rate----													
O-xylene				17900	61200									79100
PRINTING INK				6900										6900
SOAP	80													80
SODIUM CARBONATE Solvay Process										7790				7790
Natural	4950													4950
SYNTHETICS														
Fibers														
Acetate				1000										1000
Dacron	3850													3850
Nylon	1320			11300										12620
Viscose Rayon											15173			15173
Polyethylene														
High Density				26300										26300
Low Density				30900										30900
Polypropylene	5100			1100										6200

TABLE 6-15 (Continued)

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE CHEMICAL PROCESS INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Particulate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
Polystyrene				4700										4700
Polyvinyl chloride	3600			12000										15600
Resins														
ABS-SAN				1127										1127
Acrylic				31000										31000
Alkyd				187										187
Phenolic				2476										2476
Polyester	5540													5540
Urea-melamine				1806										1806
SBR rubber	130			240										370
SUBTOTAL	19540			124136							15173			158849
VARNISH				18100										18100
TOTAL	33871	259590	98900	2817636	5299700	23500	2	18067	44	4466790	155499	1056000		14229599

*A case for which there was no demonstrated control technology. This value was not included in any subtotal or total.

(1) Source characterized by decreasing capacity and zero replacement rate; calculations performed for designated pollutants only.

TABLE 6-16

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE FOOD AND AGRICULTURAL INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Particulate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
AGRICULTURAL														
Cotton Ginning	4800						3							4803
Fertilizer														
Ammonium sulfate	9900													9900
Diammonium phosphate	2600					134				17058				19792
Granulated triple superphosphate														
Production						83								83
Storage	470					9.5								480
Nitrate	7900	720*								16067				23967
Normal superphosphate(2)						394								394
ROP triple superphosphate(2)						34								34
Superphosphoric acid														
Submerged combustion(2)						3.3		18						21
Vacuum evaporation						2.3								2
Pesticides							8953							8953
SUBTOTAL	25670					660	8956	18		33125				68429
FOOD														
Animal feed defluorination	160					2123								2283
Animal husbandry														
Beer processing	7300			43000										50300
Canneries														
Castor bean processing	... Industry no longer exists...													
Coffee roasting	90	15*		290										380
Deep fat frying	6000			5300										11300
Direct firing of meats	19500			30300										49800
Feed milling & storage														
Alfalfa dehydrating	1300													1300
Other	7300													7300
Fish processing (fish meal cookers & driers)	4										8			12

TABLE 6-16 (Continued)

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE FOOD AND AGRICULTURAL INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Particulate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
Grain handling & processing														
Transfer	90700													90700
Screening, cleaning	80800													80800
Drying	7400													7400
Processing	111000													111000
Meat packing														
Meat smoke-houses	170			170	500*									340
Poultry processing														
Rendering														
Starch manufacturing	2300													2300
Stockyards & slaughterhouses														
Sugar cane processing														
Bagasse burning	2600													2600
Field burning(1)	84000	11200		112000	561000									768200
Vegetable oil manufacturing	13200			37400										50600
Whiskey processing	15520			1540										17060
SUBTOTAL	449344	11200		230000	561000	2123					8			1253675
OTHER														
Pharmaceuticals							43							43
Tanneries														
SUBTOTAL							43							43
TOTAL	475014	11200		230000	561000	2783	8999	18		33125	8			1322147

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* A case for which there was no demonstrated control technology. This value was not included in any subtotal or total

(1) En was applied to both new and existing capacity

(2) Source characterized by decreasing capacity and zero replacement rate; calculations performed for designated pollutants only

TABLE 6-17

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE MINERAL PRODUCTS INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Particulate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
ASPHALT														
Batching	25000		2300	35700*										27300
Roofing														
Saturator	2400													2400
Blowing	1100			2400	1400									4900
CONCRETE														
Batching	9680													9680
Cement plants (Kilns, clinker coolers, etc.)	5200	25100	334900											365200
MINING														
Sand and gravel	21700													21700
Stone quarrying and processing	91100													91100
Lead Ore	297								29					326
PROCESSING														
Brick and related clay products	12400	2000*	5500	620*	1300*	15550								33450
Calcium carbide	----Source characterized by decreasing capacity and zero replacement rate----													
Castable refractory	90					290								380
Ceramic clay	4100	1000*				5520		146300						155920
Clay & flyash sintering														
Clay	420													420
Flyash	990													990
Coal cleaning (drying)	7500		10200											17700
Fiberglas														
Wool processing	0	880	2800	1400	60	36								5176
Textile processing	670	6300	8200		990	4664								20824
Frit	940					2398							592	3930
Glass														
Soda lime glass	15700	17100*	35600*											15700
Opal glass	250	230*	510*			4127								4377
Gypsum	2700													2700
Lime	42500	5600*	9400											51900
Mineral wool	1100	160*	30*	2000	161000*									3100
Perlite	610													610

TABLE 6-17 (Continued)

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE MINERAL PRODUCTS INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr									TOTAL
CATEGORY	Particulate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals		
Phosphate rock															
Calcining	630														630
Drying	3800														3800
Grinding	10500														10500
TOTAL	261377	32280	373300	5800	2450	32585		146300	29				592		854713

*A case for which there was no demonstrated control technology. This value was not included in any subtotal or total.

TABLE 6-18

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE METALLURGICAL INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Parti-culate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
RIMARY METALS														
Aluminum smelters	15700		218000*			94900								110600
Coke Ovens														
Bee-hive oven (1)										790*	2600*			
By-product oven	59600	720*	900	77900	22700*					9960	181000			329360
Copper smelters	28400		1740000											1766400
Ferroalloy	5600				41600				11					47211
Iron & Steel plants														
Blast Furnace	0				53280								0	53280
BOF	0				4130000	1							37	4130038
Electric Arc	8700				225000	347							3335	237382
Open hearth (1)						1367							57	1424
Sintering	6200		53600*		786000*									6200
Scarfing	2400													2400
Lead smelters	250		177000						29					177279
Zinc smelters	240		741000											741240
SUBTOTAL	125090		2658900	77900	4449880	96615			40	9960	181000		3429	7602814
ECONDARY METALS														
Aluminum production														
Sweat furnace	460													460
Reverb furnace	1900							130000				65834		197734
Brass & Bronze smelting	50								22				205	277
Cast iron foundry														
Core ovens				63700										63700
Cupola furnace	----Source characterized by decreasing capacity and zero replacement rate----													
Electric furnace	27500													27500
Copper														
Material handling	1400													1400
Smelting & refining	1900													1900
Lead smelter														
Blast furnace	6	5*	1400		6000				58					7464
Pot furnace	20								25					45
Reverb furnace	30	140*	29600						646					30276

TABLE 6-18 (Continued)

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE METALLURGICAL INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Parti-culate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
Magnesium smelting	20	1*		10	.5									31
Steel foundries	27900	2700*												27900
Zinc														
Distillation	129	9*												129
Sweating	196	5*		180	1									377
SUBTOTAL	61511		31000	63890	6002			130000	751			65834	205	359193
TOTAL	186601		2689900	141790	4455882	96615		130000	791	9960	181000	65834	3634	7962007

*A case for which there was no demonstrated control technology. This value was not included in any subtotal or total.

(1) Source characterized by decreasing capacity and zero replacement rate; calculations performed for designated pollutants only.

TABLE 6-19

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM EVAPORATION LOSS SOURCES IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Parti-culate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
DEGREASING				527000										
DRY CLEANING				204000										
GRAPHIC ARTS														
Gravure				128000										
Flexography				115000										
Lithography				73900										
Letterpress				77500										
Metal Decorating				69100										
SUBTOTAL				463500										
PETROLEUM STORAGE AND TRANSFER														
Petroleum - Refueling				384000										
Petroleum - Service Stations				175000										
Petroleum Storage														
Aviation Gasoline														
Working				0										
Breathing				0										
Crude Oil														
Working				0										
Breathing				0										
Distillate Oil														
Breathing				31700										
Gasoline														
Working				0										
Breathing				0										
Jet Fuel														
Working				0										
Breathing				0										
Kerosene														
Breathing				1600										
Special Naptha														
Working				0										
Breathing				0										
SUBTOTAL				33300 (storage only)										

TABLE 6-19 (Continued)

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM EVAPORATION LOSS SOURCES IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Parti-culate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
PETROLEUM STORAGE AND TRANSFER (CONTINUED)														
Petroleum Transfer - Non Pipeline														
Aviation Gasoline				990										
Crude Oil				11300										
Gasoline				32400										
Jet Fuel				4200										
Special Naphtha				130										
SUBTOTAL				49020	(transfer only)									
INDUSTRIAL SURFACE COATING				2560000										
TEXTILE PROCESSING														
Heat Setting/Finishing				850										
Texturizing				170										
Carpet manufacturing				590										
TOTAL				4397430										

TABLE 6-20

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE PETROLEUM INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Particulate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
FCCU	3800		259000*		0					51200			870	55870
GASOLINE ADDITIVES														
Sodium Lead Alloy (1)									186					186
Electrolytic (1)									4.3					4
TCCU AND HCCU (1)										586			204	792
PROCESS GAS COMBUSTION	1300	9100	0	2600										13000
VACUUM DISTILLATION				83800										83800
MISC. POINT SOURCES				505000										505000
REFINERY FUEL GAS - SULFUR RECOVERY			17500								118461			135961
TOTAL	5100	9100	17500	591400					190	51788	118461		1074	794613

(1) Source characterized by decreasing growth and zero replacement rate; calculations performed for designated pollutants only.

TABLE 6-21

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM THE WOOD PRODUCTS INDUSTRY IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Parti-culate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
WOOD PROCESSING														
Pulpboard	700													700
Plywood	22600			6200										28800
SUBTOTAL	23300			6200										29500
WOOD PULPING														
Kraft process (sulfate)	0		10600	3300	471000						113700			598600
Sulfite	0		54000											54000
NSSC			110000											110000
SUBTOTAL			174600	3300	471000						113700			762600
TOTAL	23300		174600	9500	471000						113700			792100

TABLE 6-22

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON EMISSIONS FROM ASSEMBLY PLANTS IN 1985

	Criteria Pollutant Impact (Ts-Tn) Ton/Yr					Designated Pollutant Impact (Ts-Tnd) Ton/Yr								TOTAL
CATEGORY	Particulate	NO_X	SO_X	HC	CO	Fluoride Cmpds.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	
AUTOMOBILE				42900										42900
CABLE COVER MANUFACTURING(1)									4.8					5
CAN MANUFACTURING(1)									21					21
LEAD ACID BATTERY	1000			210				1980	250*					3190
TYPE METAL PRODUCTION(1)									75					75
TOTAL	1000			43110				1980	101					46191

*A case for which there was no demonstrated control technology. This value was not included in any subtotal or total.

(1) Source characterized by decreasing capacity and zero replacement rate; calculations performed for designated pollutants only.

TABLE 6-23

CONVERSION TABLES FOR
ENGLISH TO METRIC UNITS

To Convert From...	To	Multiply By
Tons	Metric Tons	.91
Lb	Kilograms	.45
Lb/Ton	Kg/Metric Ton	.50
Lb/10^6 BTU	Kg/10^6 KCAL	1.80
Lb/10^3 Ft^3	Kg/10^3 M^3	16.00
Lb/10^6 Ft^3	Kg/10^6 M^3	16.00
Lb/Acre	Kg/Hectare	1.12
Lb/Hp-Yr	Kg/KW-Yr	.61
Lb/Gal	Kg/Liter	.12
Lb/10^3 Gal	Kg/10^3 Liter	.12
Lb/BBL	Kg/10^3 Liter	2.85
Lb/Ft^2	Kg/M^2	4.88
Lb/Bale	Kg/Bale	.45

TABLE 6-24

A SUMMARY OF ODOR OCCURRENCE AND ODOR CONTROL FOR VARIOUS INDUSTRIAL CATEGORIES (17) (18) (19)

INDUSTRIAL CATEGORY	SOURCES OF ODORS	ODORANT SPECIES IDENTIFIED	REPORTED UNCONTROLLED ODOR EMISSION LEVELS (ODOR UNITS)*	CONTROLS GENERALLY APPLIED
CHEMICAL PROCESS INDUSTRY				
Paint Manufacturing	Grinding and thinning operations	Aliphatic and aromatic hydrocarbons, alcohols, ketones, esters		Condensation, adsorption, and incineration
Phthalic Anhydride Manufacturing	Reactor and condensor off-gas	Anhydrides, organic acids quinones	1,800 - 3,500	Afterburner
Soap Manufacturing	Raw material shortage vents, separators, drying tanks, spray dryers	Fatty acids, amine compounds		Condensation, incineration, chlorine and acid scrubbing
Synthetic Detergent Manufacturing	Spray dryer	Dimethylamine		Scrubbing, 95% efficiency
Synthetic Rubber Manufacturing	Rubber Dryers			Waste gas collection and flare
Varnish Manufacturing	Cookers	Fatty acids, glycerine	10,000 - 200,000	Afterburner
Viscose Rayon. Production	Acid recovery system Aging tanks	Hydrogen sulfide Sodium bisulfide		Scrubbing 95% efficiency activated carbon
FOOD AND AGRICULTURAL INDUSTRY				
Alfalfa Dehydrating	Rotary dryer	Odorous material in dust discharge from dryer		Cyclone and fabric filter in series
Coffee Roasting	Roaster	Acrolein, alcohols, organic acids, nitrogen and sulfur compounds		Afterburner 60% efficiency
Fish Meal Processing	Fish meal dryers	Amine compounds, aldehydes hydrogen sulfide, organic acids	1,000 - 5,000	Chlorine scrubbers 93% efficiency
Inedible Rendering	Receiving areas, wet cookers, dry cookers, dryers, presses, blood and feather cookers	Ammonia, triethylamine, monoethlyamine, diethylamine, hydrogen sulfide, mercaptans, other amine compounds, sulfur compounds	Dry cookers: 5,000 - 500,000 Dry blood cooler: 10,000 - 1,000,000	Condensen, chlorination scrubbers, afterburner 99% efficiency
Livestock Slaughtering	Animal pens, storage areas (decaying animal flesh and blood)	Amines and sulfur compounds, ammonia		Drainage of water in animal pens, proper housekeeping and sanitation
Meat smokehouses	Smokehouse exhaust	Aldehydes, organic acids		Precipitator, scrubber and afterburner
Pesticides	Condensers, dryers, process reactors			Surface condensors, scrubbers
Pharmaceuticals	Fermentation off-gas			Scrubbing, condensing
Spent Grain Dryers (Whiskey and Beer)	Dryer	"Burnt grain" odor, lactic acid		Incineration, scrubbing
Tanneries	Waste and hide storage	Ammonia		Proper housekeeping

TABLE 6-24 (Continued)

A SUMMARY OF ODOR OCCURRENCE AND ODOR CONTROL FOR VARIOUS INDUSTRIAL CATEGORIES (17) (18) (19)

INDUSTRIAL CATEGORY	SOURCES OF ODORS	ODORANT SPECIES IDENTIFIED	REPORTED UNCONTROLLED ODOR EMISSION LEVELS (ODOR UNITS)*	CONTROLS GENERALLY APPLIED
MINERAL PRODUCTS INDUSTRY				
Asphalt Batching Plants	Truck loading of hot mix	"Asphalt"odor		Lime-water slurry coating of truck
Asphalt Roofing Manufacture	Saturator, loopers, etc.	Organic sulfur and nitrogen compounds, phenolics		Control along with particulate mist, baghouse, spray scrubber or 2 stage electrostatic precipitator
	Air blowing	Sulfur compounds, hydrocarbons		Scrubbing, incineration
METALLURGICAL INDUSTRY				
Cast Iron Foundry	Core oven	Aldehydes, organic acids solvents		After burner, lower baking temperature, modify core binder composition
Coke Production	Coke oven - charging, unloading, and heat cycle	Hydrogen sulfide, ammonia, phenols		Incineration and scrubbing on charging
EVAPORATION LOSS SOURCES				
Synthetic Drycleaning Plant	Dryers	Perchloroethylene		Activated carbon (solvent recovery)
PETROLEUM INDUSTRY				
Refinery	Cracking Units, catalytic reforming units, catalyst regenerators, untreated gas stream leaks	Hydrogen sulfide, organic sulfide, mercaptans, phenolic, aldehyde, organic amines, aromatic compounds, ammonia		Waste gas combustion and scrubbing
Sulfur Recovery Plant	Stack exhaust	Hydrogen sulfide		Incinerator
WOOD PRODUCTS INDUSTRY				
Kraft Pulp Mills	Recovery furnace, lime kiln, direct contact evaporator, blow tank, multi-effect evaporators	Hydrogen sulfide, methy mercaptan, dimethyl disulfide, dimethyl sulfide		Proper process operation and control,

TABLE 6-24 (Continued)

A SUMMARY OF ODOR OCCURRENCE AND ODOR CONTROL FOR VARIOUS INDUSTRIAL CATEGORIES (17) (18) (19)

INDUSTRIAL CATEGORY	SOURCES OF ODORS	ODORANT SPECIES INDENTIFIED	REPORTED UNCONTROLLED ODOR EMISSION LEVELS (ODOR UNITS)*	CONTROLS GENERALLY APPLIED
WOOD PRODUCTS INDUSTRY (CONT.)				
Kraft Pulp Mills (cont.)				Condensation and incinerator for digester and multi-effect evaporator Black liquor oxidation for direct contact evaporate and recovery furnace Proper washing of lime mud Alkaline scrubber on kiln
Plywood Production	Veneer Dryers	Esters, alcohols, fatty acids		Condenser
WASTE WATER TREATMENT (NON-COMBUSTION)				
Treatment Plant	Clarifier, screens, sludge treating, processes, storage ponds	Hydrogen sulfide, ammonia carbon disulfide, mercaptan, amines		Proper design, operation and control of plant, chemical treatment of water streams, good housekeeping

* An odor unit represents the number of dilutions of fresh air that must be added to a sample so that the resulting odor perception is at the odor threshold level.

7.0 ANALYSIS

7.1 ANALYSIS OF RESULTS

Our findings indicate that new source performance standards could have a significant impact on 1985 national emissions as summarized in Tables 7-1 and 7-2. Of the total 71 million tons potentially achievable through NSPS, nearly 38% is attributable to control of carbon monoxide. The next greatest contribution would be 23% for control of SO_x followed by hydrocarbons (16%), all designated pollutants (10%), particulates (7.4%) and lastly NO_x (6.6%). Controls for all pollutants from stationary combustion sources (Category I) would account for 57% of the total potential reduction that could be achieved by NSPS. An additional 20% could be realized by controls for all pollutants from the Chemical Process Industry (Category II).

In particular, the control of SO_x, particulate and NO_x from industrial size boilers (0.3 to 250 million BTU per hour) could have the effect of reducing emissions of these pollutants by 4 million, 1 million, and 600,000 tons respectively in 1985. This corresponds to a reduction of 25% of the total SO_x reduction potentially achievable by NSPS for all source categories, 19% of the total potential for particulate and 13% for NO_x. Such control could be realized by a fuel switching program combined with combustion modification and the use of fuel additives. However, the future potential of fuel switching may be in doubt and alternative approaches would have to be considered. Standards should be written so as to preclude any increase in carbon monoxide and hydrocarbons from all combustion sources--a potential side effect from NO_x and particulate control. Regu-

TABLE 7-1

IMPACT OF NEW SOURCE PERFORMANCE STANDARDS ON 1985 NATIONAL EMISSIONS FROM STATIONARY SOURCES
(TONS/YEAR)

POTENTIAL EMISSION REDUCTION ACHIEVABLE IN 1985

CATEGORY	Partic.	NO_x	SO_x	HC	CO	Fluorid.	Hazard. Pollut.	Acid Mist	Lead	Ammonia	Sulfides	Chlorine	Trace Metals	TOTAL	% OF GR. TOT.
STATIONARY COMBUSTION SOURCES	4303960	4386964	12867700	3065290	15955960	48067			6200			34700	10880	40679721	57.2
CHEMICAL PROCESS INDUSTRY	33871	259590	98900	2817636	5299700	23500	2	18067	44	4466790	155499	1056000		14229599	20.0
FOOD & AGRICULTURAL INDUSTRY	475014	11200		230000	561000	2783	8999	18		33125	8			1322147	1.9
MINERAL PRODUCTS INDUSTRY	261377	32280	373300	5800	2450	32585		146300	29				592	854713	1.2
METALLURGICAL INDUSTRY	186601		2689900	141790	4455882	96615		130000	791	9960	181000	65834	3634	7962007	11.2
EVAPORATION LOSS SOURCES				4397430										4397430	6.2
PETROLEUM INDUSTRY	5100	9100	17500	591400					190	51788	118461		1074	794613	1.1
WOOD PRODUCTS INDUSTRY	23300		174600	9500	471000						113700			792100	1.1
ASSEMBLY PLANTS	1000			43110				1980	101					46191	.1
TOTALS	5290223	4699134	16221900	11301956	26745992	203550	9001	296365	7355	4561663	568668	1156534	16180	71078521	

TABLE 7-2

SUMMARY OF POTENTIAL EMISSION REDUCTION ACHIEVABLE IN 1985 THROUGH NEW SOURCE PERFORMANCE STANDARDS

(TONS/YEAR)

POLLUTANT	POTENTIAL REDUCTION IN 1985 THROUGH NSPS (Tons/Year)	% OF TOTAL ACHIEVABLE REDUCTION
CARBON MONOXIDE	26,745,992	37.6
OXIDES OF SULFUR	16,221,900	22.8
HYDROCARBONS	11,301,956	15.9
PARTICULATE	5,290,223	7.4
OXIDES OF NITROGEN	4,699,134	6.6
AMMONIA	4,561,663	6.4
CHLORINE	1,156,534	1.6
SULFIDES	568,668	.8
ACID MIST	296,365	.4
FLUORIDE	203,550	.3
TRACE METALS	16,180	.02
HAZARDOUS POLLUTANTS	9,001	.01
LEAD	7,355	.01
TOTAL	71,078,521	

lations more stringent than existing NSPS regulations for boilers rated at greater than 250 million BTU per hour have the potential of reducing SO_x emissions by 8 million tons (49% of total achievable) and NO_x emissions by 1 million tons (21% of total) in 1985. A demonstrated control technology employing alkaline scrubbers and combustion modification could effect this reduction. Such a substantial reduction results from the large increase in new capacity by 1985, not from a large differential between E_S and E_N.

The largest single reduction of NO_x emissions was from stationary gas turbine engines. By using water injection, a reduction of over 1.2 million tons of NO_x (26% of total achievable reduction from all NO_x sources) could be obtained in 1985. Evaluation of small boiler units less than 0.3 million BTU per hour indicates that significant pollutant reduction could be realized if adequate control methods could be demonstrated. An accelerated research and development effort in this area would be warranted. In general, we found that proper operating, maintenance and "good housekeeping" practices are key factors in keeping emissions to a minimum. Chloride emissions from municipal incinerators will increase in the future due to increases in the general consumer use of PVC plastics. Additional controls for municipal incinerators may be needed to counter this trend in increased chloride emissions.

Standards of performance to control hydrocarbon emissions from industrial surface coating operations should be given high priority in an overall strategy program. We determined that the use of incineration, carbon adsorption techniques, reformulation to non-reactive solvents or electrocoating could reduce hydrocarbon emissions by 2.5 million tons (22% of total achievable) in 1985. This is the largest potential reduction of hydrocarbons from a single source category. A reduction in hydrocarbon emissions in excess of 500,000 tons (4% of total achievable) could be realized by applying activated carbon adsorption control techniques to degreasing units.

Significant reduction in the emission of hydrocarbons, carbon monoxide and ammonia could be realized with standards for several sources within the chemical process industry. Controls for ammonia and hydrocarbons from synthetic ammonia plants would reduce 1985 emissions of these two pollutants by 2 and 1 million tons respectively. Incineration control for carbon monoxide from the synthetic ammonia plants employing carbon monoxide absorbers and regenerators could reduce emissions by an additional 1.7 million tons in 1985. Carbon black manufacture by the furnace process has the potential for significant emissions of carbon monoxide and hydrocarbons. New source performance standards for these pollutants could achieve a reduction of 2.5 million tons of carbon monoxide and over 300,000 tons of hydrocarbons in 1985.

Of the 200 source categories evaluated in this study, 20 showed a continuing downward trend in production coupled with a failure to replace obsolete capacity. For the most part, they are being phased out in favor of new, or more economically attractive processes. For example, the channel process for carbon black manufacture is being replaced by the thermal and furnace processes which have shown higher yields and lower costs. Castor bean processing, since 1971, has not been an active industry within the U.S. and it is not expected to revive(20). Table 7-3 presents a summary of these sources. As discussed in Section 5.3.3, we assumed that obsolete capacity for these sources was not replaced due to the lack of economic incentive. Since the value of P_C is negative and the value of P_B is zero, there is no new capacity to which a new source standard would apply. However, under Section 111(d) of the Clean Air Act, the States are responsible for drafting, maintaining and enforcing regulations for the control of designated pollutants from existing sources for which NSPS have been set for new sources. It is possible, therefore, that NSPS for designated pollutants could be promulgated for a source with a negative growth trend thereby requiring the States to enforce regulations for existing plants even though they were becoming fewer in number. This possibility was accounted for in our analysis and the input and output values were presented in the appropriate Tables in Section 6.0. Due to the decline in existing capacity, the emission impact of a standard would be the greatest in the first year which, in the case of this study, is 1976 and the least in the last year (1985). As a result we have presented in Table 7-4 the values of T_S, T_{ND} and $(T_S - T_{ND})$ for each year between 1975 and 1985 for those categories with decreasing capacity which were capable of emitting a designated pollutant. Since different rates of decline in existing capacity exist for each category, a numerical ranking of $(T_S - T_{ND})$ in one year may differ from that in another. If standards for any of these source categories are to be considered, the overall strategy should look to see in which year and for which categories such standards would be most effective in reducing nationwide emissions.

Standards to control open field burning of sugar cane and other agricultural wastes could have a significant impact on atmospheric emis-

TABLE 7-3

SOURCES CHARACTERIZED BY
DECREASING CAPACITY
AND
ZERO REPLACEMENT RATE

BEE-HIVE COKE OVENS

CABLE COVER MANUFACTURING

CALCIUM CARBIDE

CAN MANUFACTURING

CARBON BLACK - CHANNEL PROCESS

CAST IRON FOUNDRY - CUPOLA FURNACE

CASTOR BEAN PROCESSING(1)

CONICAL INCINERATORS

GASOLINE ADDITIVES - SODIUM LEAD ALLOY

GASOLINE ADDITIVES - ELECTROLYTIC

IRON AND STEEL PLANTS - OPEN HEARTH FURNACE

LEAD PIGMENT MANUFACTURING

NORMAL SUPERPHOSPHATE FERTILIZER

OPEN BURNING - INDUSTRIAL/COMMERCIAL

PETROLEUM REFINERY - TCCU AND HCCU

PHTHALIC ANHYDRIDE - NAPHTHALENE PROCESS

ROP TRIPLE SUPERPHOSPHATE FERTILIZER

SODA ASH/SODIUM CARBONATE - SOLVAY PROCESS

SUPERPHOSPHORIC ACID - SUBMERGED COMBUSTION

TYPE METAL MANUFACTURING

(1) Industry no longer exists in the U. S.

SOURCES CHARACTERIZED BY DECREASING CAPACITY AND ZERO REPLACEMENT RATE

-NSPS CONTROL POTENTIAL FOR DESIGNATED POLLUTANTS-

Industry/Pollutant	Emissions or Emission Impact	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
CABLE COVER PRODUCTION Lead	Ts 1000 Ton/Yr	.00933	.00894	.00857	.00820	.00786	.00753	.00721	.00691	.00662	.00634
	Tnd 1000 Ton/Yr	.00232	.00222	.00213	.00204	.00195	.00187	.00179	.00172	.00164	.00157
	Ts-Tnd Ton/Yr	7.0	6.7	6.4	6.2	5.9	5.7	5.4	5.2	5.0	4.8
CAN MFG Lead	Ts 1000 Ton/Yr	.0809	.0743	.0683	.0627	.0576	.0529	.0486	.0446	.0410	.0377
	Tnd 1000 Ton/Yr	.0368	.0338	.0310	.0285	.0262	.0240	.0221	.0203	.0186	.0171
	Ts-Tnd Ton/Yr	44	41	37	34	31	29	27	24	22	21
FERTILIZER-NSP Fluoride	Ts 1000 Ton/Yr	.9224	.8557	.7939	.7366	.6834	.6340	.5882	.5456	.5062	.4696
	Tnd 1000 Ton/Yr	.1488	.1380	.1281	.1188	.1102	.1023	.0949	.0880	.0817	.0757
	Ts-Tnd Ton/Yr	774	718	666	618	573	532	493	458	425	394
FERTILIZER-ROP TSP Fluoride	Ts 1000 Ton/Yr	.0943	.0893	.0843	.0798	.0755	.0713	.0675	.0638	.0603	.0570
	Tnd 1000 Ton/Yr	.0377	.0357	.0337	.0319	.0302	.0285	.0270	.0255	.0241	.0228
	Ts-Tnd Ton/Yr	57	54	51	48	45	43	41	38	36	34
GASOLINE ADDITIVE-ELECTROLYTIC Lead	Ts 1000 Ton/Yr	.0283	.0251	.0224	.0199	.0177	.0158	.0140	.0125	.0111	.0099
	Tnd 1000 Ton/Yr	.0159	.0142	.0126	.0112	.0099	.0089	.0079	.0070	.0062	.0055
	Ts-Tnd Ton/Yr	12.5	11	10	9	8	7	6	5.5	5	4.3
GASOLINE ADDITIVE-SODIUM LEAD ALLOY Lead	Ts 1000 Ton/Yr	.8415	.7486	.6657	.5922	.5270	.4689	.4171	.3710	.3300	.2935
	Tnd 1000 Ton/Yr	.3092	.2751	.2446	.2176	.1937	.1723	.1533	.1363	.1213	.1079
	Ts-Tnd Ton/Yr	532	474	421	375	333	297	264	235	209	186
IRON AND STEEL-OPEN HEARTH FURNACE Fluoride	Ts 1000 Ton/Yr	2.163	2.083	2.002	1.921	1.841	1.760	1.679	1.598	1.517	1.437
	Tnd 1000 Ton/Yr	.106	.102	.098	.094	.090	.086	.082	.078	.074	.070
	Ts-Tnd Ton/Yr	2057	1981	1904	1827	1751	1674	1597	1520	1443	1367
Trace Metals	Ts 1000 Ton/Yr	.382	.368	.354	.339	.325	.311	.297	.282	.268	.254
	Tnd 1000 Ton/Yr	.297	.286	.275	.264	.253	.241	.231	.219	.208	.197
	Ts-Tnd Ton/Yr	85	82	79	75	72	70	66	63	60	57
LEAD PIGMENT MFG Lead	Ts 1000 Ton/Yr	.0861	.0799	.0741	.0688	.0638	.0592	.0549	.0510	.0473	.0439
	Tnd 1000 Ton/Yr	.00026	.00024	.00023	.00021	.00019	.00018	.00017	.00016	.00014	.00013
	Ts-Tnd Ton/Yr	86	80	74	69	64	59	55	51	47	44
TYPE METAL PRODUCTION Lead	Ts 1000 Ton/Yr	.2918	.2732	.2545	.2359	.2173	.1987	.1800	.1614	.1428	.1242
	Tnd 1000 Ton/Yr	.1166	.1091	.1017	.0942	.0868	.0794	.0719	.0645	.0570	.0496
	Ts-Tnd Ton/Yr	175	164	153	142	131	119	108	97	86	75

sions. If total prohibition of such practices were to be considered, the following reduction in emissions could be realized:

Pollutant	Emission Reduction in 1985 (tons/year)	Percent of Total Potential Nationwide Reduction*
Particulate	2,687,100	51%
NO_X	317,400	7%
Hydrocarbon	3,174,500	28%
Carbon Monoxide	15,873,300	59%

*On a per pollutant basis

For the purpose of this particular analysis we assumed that all acreage burned in 1985 would be subject to the regulation not just the increase in new acreage burned between 1975 and 1985. Accordingly, the values of emission impact (T_S - T_N) reduce to just T_S for total prohibition (E_N=0). It is recognized that total elimination of such practices may be impractical due to the lack of viable alternatives; however, the results indicate the maximum potential reduction achievable through NSPS.

7.2 ANALYSIS OF PROCEDURES

The results of this study are presented for the year 1985 and are based on a datum of 1975. A re-analysis of emission impact may be conducted, however, for any baseline year and for any target year with the substitution of proper data for the newly defined ground rules. In addition, a re-evaluation of emission impact can be made for a given baseline year by simply changing one or all of the input variables. This flexibility permits a rapid redetermination of impact if new or more up-to-date information becomes available.

Although the Model is flexible in terms of the ability to change input variables and reevaluate emission impact, caution must be exercised when doing so. Details for each calculation performed can be found in the appropriate Appendix and these calculations should be reviewed prior to a reanalysis to determine the methodology by which each factor was evaluated. For example, uncontrolled emission factors were, in certain instances, synthesized values determined by weighting emissions by process type, fuel type or product mix for specific application to the Model. Any change to this variable should be considered within the same context so as not to yield erroneous results. Similarly, a change in the value of production capacity, A, should be made within the same context as it was originally determined. Many times, A represents the capacity of a specific process or operation within a category, not necessarily the capacity of the entire category.

It must be noted that the extrapolation of Model factors from the 1975 data base to 1985 is subject to the many biases which could occur during that time period and that these changes would have a subsequent effect on the validity of calculated emissions. Two such factors are particularly prone to these potential future biases, P_C and E_S. For example, P_C for a specific source could be affected by availability of fuel and raw materials, cost of money, industry and environmental regulations, or competition from other industries. A value of E_S, determined from State regulations weighted by recent or existing capacity, could change as the geographical distribution of that capacity changes as the result of new plant additions. A similar argument can be stated for the typical plant size upon which a value of E_S is based. Plant consolidation and advancements in process or manufacturing technology have generally resulted in an historic trend towards larger plants. This could result in a changing value of E_S. In addition, State regulations will be subject to change (generally towards more stringent levels), interpretation, variance and lack of enforcement.

7.3 OVERALL ASSESSMENT OF EMISSION IMPACT

It is recognized that priorities will not and cannot be based solely on the effect that standards will have in preventing atmospheric emissions. Development of emission impact is just the first step in determining the order of standard setting and this broad analysis will be refined into an overall strategy delineating the priorities by which standards should be set. Such refinement is expected to include economic factors such as cost and availability of capital, availability of fuel and raw materials, pollutant and geographical priorities and other ramifications.

Timing factors are also a necessary consideration in an overall strategy plan. For example, if no control technology exists, effective standards cannot be imposed. It is, therefore, necessary to defer the standard setting process until appropriate control methods and techniques have been demonstrated. An accelerated Research and Development effort for the control of specific pollutants and sources would become part of the overall plan of action. An additional timing factor, availability of appropriate test methods, could again defer the standard setting process if test requirements were necessary to enforce the standard.

Throughout the study to determine emission impact, the overall strategy plan for standard setting was considered. For example, there were several instances where an applicable control technology (or transferable technology) had not been developed. By employing hypothetical values of E_N for these cases, the Model was used to develop a listing of sources, ranked in order of decreasing emission reduction, for which priorities for research and development efforts for applicable control technology could be concentrated. For these sources, we feel that plant surveys and discussions with control device manufacturers are warranted to locate the most recent advances in the state-of-the-art or unique installations which have not as yet been presented in the literature. This should be done when standards for a specific source are being considered.

The units of emission factors and capacities were developed to be compatible with each other and to be consistent with the general terminology and method of measurement within the category. For example, production and capacity within the phosphate fertilizer industry are expressed on the basis of the P_2O_5 content of the product. Model factors were, therefore, developed in these units. For other sources, Model factors were specified on the basis of either input or output, whichever was the industry standard or measured quantity. Careful attention must be paid to the units of these various Model factors if they are to be employed in the overall strategy plan.

Control technology for the majority of emission sources was based on the use of a scrubber, baghouse or other mechanical contrivance. However, there were several instances where fuel switching, process modification, raw material substitution or redesign of process equipment constituted the best means of control. Before standards of performance can be set for a source, the long term outlook for the availability and effect of the control method must be evaluated. In general, there would be no apparent problem with the future availability of a mechanical control device. However, an abundant fuel or raw material supply today may be essentially non-existent or too costly at some future date to be a viable control technique. Also, control of one pollutant could result in the formation of or increase in another. A prime example is gas turbine engines for which NO_x control could result in an increase in carbon monoxide emissions. The use of afterburners for control of solvent emissions could result in excessive

NO_x formation at high temperatures. Strategies must, therefore, be refined to account for these effects by permitting optional control methods, by requiring control for more than one pollutant, or by enforcing "good housekeeping" practices.

The environmental impact of fugitive emissions (i.e., emissions from processes, storage piles and other sources which are not captured or treated by control systems) has not been evaluated in this study because of an almost complete lack of emission data. These emissions, since they often occur at ground level, could be expected to have a greater impact on ambient air quality near the stack than actual stack emissions. In addition, the scant data available indicate that fugitive emissions could greatly exceed, in terms of mass/unit time, well controlled point source emissions. Accurate environmental impact assessment must, therefore, await compilation of fugitive emission levels from all processes and this should be a high priority R & D objective.

The geographical distribution of source categories should be considered within an overall strategy plan. For example, emissions being equal, should control be placed on a source whose plants are clustered in one area of the country or a source whose plants are widely distributed? A similar analysis could be made for groups of sources considering the superimposition of pollutant emissions and their overall effect on the degradation of air quality in "high density" areas.

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APPENDIX 1

CALCULATION SHEET BIBLIOGRAPHY FOR APPENDIX 4

Due to the limited availability of many of the reference sources, a cross-reference has been included to facilitate retrieval. The number(s) in parentheses following each reference are keyed to the following list:

Code Number	Available through...
1	APTIC, NTIS, GPO
2	EPA - OAQPS Emission Standards and Engineering Division(ESED)-Associated Personnel
2a	EPA,ESED - Gary D. McCutchen
2b	EPA,OAQPS - Joseph J. Sableski
2c	EPA,ESED - Eric Noble
2d	EPA,ESED - Fred Porter
2e	EPA,SDAD - William Hamilton
2f	EPA,ESED - Susan Wyatt
2g	EPA,ESED - William King
2h	EPA,ESED - Randy Seiffert
3	TRC--The Research Corporation of New England - Thomas G. Hopper
4	Government documents section of State Library
5	Technical section of local library
6	Contractor preparing report
7	Federal Register
8	Department of Commerce
9	Bookstore - technical section
10	Publisher
11	Air Pollution Control Association
12	Author(s)
13	EPA - Industrial Studies Branch
14	EPA - Compliance Monitoring Section

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APPENDIX 2

APPENDIX 1 REFERENCES USED
FOR EACH SOURCE CATEGORY

SPECIFIC REFERENCES FOR INDUSTRIAL CATEGORIES

I. STATIONARY COMBUSTION SOURCES

BOILERS, FOSSIL FUEL	
<0.3 x 10^6 BTU/hr	22,28,73,75,84,97,147,148
0.3-10 x 10^6 BTU/hr	
10-250 x 10^6 BTU/hr	
>250 x 10^6 BTU/hr	
Mixed Fuel	
Coal & Refuse	84,148,249
Oil & Refuse	
Wood Waste	43,48,73,75,84,148,236
ENGINES, STATIONARY	
Gas Turbines	
Electric Utility	32,37,84,104,105,148
Pipe Line	32,37,75,84,97,101,104,148
Internal Combustion	
Spark Ignition (Heavy Duty Gas Fired)	37,50,75,97,100,102
Diesel and Dual Fuel	37,50,75,97,100,102,103
INCINERATORS	
Auto Body	37,38,84,148
Conical	38,51
Industrial/Commercial	75,84,85,97,148,163
Municipal	62,84,85,97,147,148
Pathological	37,38,46,75,84,148
Sludge	44,266,267,268
MISCELLANEOUS COMBUSTION	
Open Burning	
Commercial/Industrial	49,75,99
Agricultural	
Orchard Heaters	75,84,97,101,148,156,247,262,263
Combustion of Waste Crankcase Oil	22,277

II. CHEMICAL PROCESS INDUSTRY

ACIDS	
Adipic	45,75,76,84,95,100,148
DMT/TPA (Nitric Acid Oxidation)	37,84,95,100,127,148
Hydrochloric	
By-product	37,42,75,95,96,142
Salt	37,42,95,142
Hydrofluoric	37,42,45,75,84,95,141,148
Nitric	37,45,60,75,84,100,144,147,148
Phosphoric	
Wet Process	37,42,84,95,148,159,234
Thermal Process	37,42,47,84,95,145,148,156
Sulfuric	20,37,75,84,147,148,161
ACRYLONITRILE	31,37,50,84,96,148
AMMONIA	
Methanator plant	37,45,75,84,144,148
Regenerator & CO-absorber plant	
CARBON BLACK	
Channel process	45,50
Furnace process	37,45,49,50,75,84,96,101,148

SPECIFIC REFERENCES FOR INDUSTRIAL CATEGORIES

II. CHEMICAL PROCESS INDUSTRY (CONT.)

CHARCOAL	37,75,84,88,93,144,148,236
CHLOR-ALKALI	
Diaphragm cells Mercury cells	37,45,52,75,84,108,146,148
CRUDE OIL & NG PRODUCTION - SULFUR RECOVERY	37,84,95,148,149
DETERGENT	5,50,75,84,148,156
ESSENTIAL OILS	
ETHYLENE DICHLORIDE (OXYCHLORINATION PROCESS)	37,50,80,84,96,148
ETHYLENE OXIDE	37,50,206,210
EXPLOSIVES	
High Low	37,44,84,93,95,144,147,148,221
FORMALDEHYDE	37,50,76,84,95,96,148
FUEL CONVERSION - COAL GASIFICATION	
High BTU Gas Low BTU Gas	84,148,256,257,258,259,260
LEAD PIGMENT	37,84,148,276,278
MALEIC ANHYDRIDE	37,84,95,128,148
PAINT	25,50,75,84,148,156,222,235
PHTHALIC ANHYDRIDE	
Naphthalene	50,76,95
O-xylene	45,50,76,78,84,95,148
PRINTING INK	37,50,75,84,144,148,156,158
SOAP	5,37,46,77,84,148
SODIUM CARBONATE	
Solvay Process	42,45,62,95,96,146
Natural	37,45,84,95,96,148,156
SYNTHETICS	
Fibers	
Acetate Dacron Nylon	37,75,84,95,148,209
Viscose Rayon	37,75,84,95,146,148
Polyethylene	
High Density Low Density	34,84,116,128,148
Polypropylene	31,75,84,116,129,148
Polystyrene	84,116,129,148
Polyvinyl chloride	75,84,116,129,148
Resins	
ABS-SAN	84,103,148,204,207,222,236
Acrylic	37,84,156,272
Alkyd	37,84,148,156,272
Phenolic	84,103,148,204,207,222,236
Polyester	37,75,84,148,209,272
Urea Melamine	84,103,148,204,207,222,236
SBR rubber	31,75,84,95,129,143,148,151,156
VARNISH	50,75,84,148,156,236

III. FOOD AND AGRICULTURAL INDUSTRY

AGRICULTURAL	
Cotton Ginning	11,37,75,84,148
Fertilizer	
Ammonium sulfate	37,40,49,84,95,148,156
Diammonium phosphate	33,37,40,75,77,84,95,148,159

SPECIFIC REFERENCES FOR INDUSTRIAL CATEGORIES

III. FOOD AND AGRICULTURAL INDUSTRY (CONT.)

Granulated triple superphosphate	
Production	33,37,40,49,75,77,84,95,148,153,159
Storage	
Nitrate	37,40,42,75,84,95,122,148
Normal superphosphate	95
ROP triple superphosphate	
Superphosphoric acid	
Submerged combustion	33,37,77,84,95,148,159
Vacuum Evaporation	
Pesticides	37,95,84,144,148,269
FOOD	
Animal feed defluorination	37,40,50,84,95,148
Animal husbandry	
Beer processing	12,37,75,84,144,148,157
Canneries	
Castor bean processing	23
Coffee roasting	6,37,75,84,148
Deep fat frying	24,37,46,84,144,148
Direct firing of meats	37,50,218,254,255
Feed milling & storage	
Alfalfa dehydrating	1,28,37,47,49,50,77,84,148
Other	
Fish processing (fish meal cookers & driers)	46,50,75,84,144,148
Grain handling & processing	
Transfer	1,37,47,75,84,144,148,236
Screening, cleaning	
Drying	
Processing	
Meat packing	
Meat smoke houses	4,37,75,84,144,148,158
Poultry processing	
Rendering	
Starch manufacturing	37,75,84,144,148,236
Stockyards & slaughterhouses	
Sugar cane processing	
Bagasse burning	3,38,75,84,93,101,148
Field burning	3,75,84,148
Vegetable oil manufacturing	2,37,84,103,148,247
Whiskey processing	12,75,84,112,148,156,236
OTHER	
Pharmaceuticals	37,95,144,216,230,270
Tanneries	

SPECIFIC REFERENCES FOR INDUSTRIAL CATEGORIES

IV. MINERAL PRODUCTS INDUSTRY

ASPHALT	
Batching	22,43,44,46,49,75,84,92,101,148,177
Roofing	
Saturator	21,37,47,75,84,144,148
Blowing	
CONCRETE	
Batching	37,75,84,146,148,215,217
Cement plants (Kilns, clinker coolers)	17,22,37,58,75,84,125,144,146,147,148,201,215,216
MINING	
Sand and gravel	37,46,47,75,84,144,148,156,215
Stone quarrying & processing	37,50,75,84,144,148,215,236
Lead ore	37,84,148,278,280
PROCESSING	
Brick and related clay products	18,22,37,49,75,84,97,144,148
Calcium carbide	95
Castable refractory	15,37,75,84,144,148
Ceramic clay	18,37,47,49,75,84,93,142,144,148,217
Clay and flyash sintering	
Clay	84,148,215,222,236
Flyash	37,75,84,148,222,236,252
Coal cleaning (thermal drying)	10,22,37,43,47,75,84,101,148,237
Fiberglas	
Wool processing	75,84,148,156,228,234
Textile processing	
Frit	37,46,75,84,144,148,234
Glass	
Soda lime glass	10,37,46,75,84,144,148,242
Opal glass	
Gypsum	37,75,84,95,144,148,152,156
Lime	22,37,42,49,50,75,84,148,192,215,242
Mineral Wool	37,46,75,84,101,144,148,156,158,
Perlite	37,46,75,84,144,148,156,215
Phosphate rock	
Calcining	37,40,47,75,77,84,95,148
Drying	
Grinding	

V. METALLURGICAL INDUSTRY

PRIMARY METALS	
Aluminum smelters	35,37,84,93,148,160
Coke ovens	
Bee-hive oven	50,97
By-product oven	37,49,50,75,84,148,153
Copper smelters	29,30,37,49,75,84,95,148
Ferroalloy	37,84,148,221,239,240
Iron & Steel plants	
Blast furnace	37,44,47,75,83,84,148,156,212,230,232,234,236,250
BOF	
Electric arc furnace	
Open hearth furnace	
Sintering	
Scarfing	

SPECIFIC REFERENCES FOR INDUSTRIAL CATEGORIES

V. METALLURGICAL INDUSTRY (CONT.)

Lead smelters	29,30,37,49,75,84,136,148
Zinc smelters	29,30,37,49,75,84,95,148
SECONDARY METALS	
Aluminum production	
Sweat furnace	37,49,84,89,95,119,132,144,148,214
Reverb furnace	
Brass & Bronze smelting	37,44,75,84,124,148,223
Cast Iron foundry	
Core ovens	7,37,46,47,50,67,68,75,84,145,148
Cupola furnace	
Electric furnace	
Copper	
Material handling	37,46,47,49,84,89,95,148,155
Smelting & refining	
Lead smelter	
Blast furnace	7,44,46,49,75,77,84,89,95,101,148,155,236
Pot furnace	
Reverb furnace	
Magnesium smelting	37,75,84,95,101,144,148,222,236
Steel foundries	37,84,148,222,236
Zinc	
Distillation	37,49,75,84,95,101,144,148,157,236,244
Sweating	

VI. EVAPORATION LOSS SOURCES

DEGREASING	34,37,46,74,84,96,144,148
DRY CLEANING	37,46,74,75,84,98,106,148
GRAPHIC ARTS	
Gravure	37,50,84,144,148,248
Flexography	
Lithography	
Letterpress	
Metal decorating	
PETROLEUM STORAGE & TRANSFER	
Nonpipeline transfer (tank cars, trucks & marine)	37,74,84,95,98,148
Refueling motor vehicles	34,37,75,84,148
Service stations	37,74,75,84,148
Tank storage	34,37,74,84,148
INDUSTRIAL SURFACE COATING	50,74,75,84,144,156,261
TEXTILE PROCESSING	
Heat Setting/Finishing	37,144,229
Texturizing	
Carpet Manufacturing	

VII. PETROLEUM INDUSTRY

FCCU	37,41,43,44,49,74,75,84,95,97,148,156
GASOLINE ADDITIVES	
Sodium Lead Alloy	276,277
Electrolytic	
TCCU AND HCCU	43,75
PROCESS GAS COMBUSTION	44,75,84,148,156,242,246
VACUUM DISTILLATION	44,75,84,148
MISC. POINT SOURCES	41,75,84,148
REFINERY FUEL GAS - SULFUR RECOVERY	37,84,148,150

SPECIFIC REFERENCES FOR INDUSTRIAL CATEGORIES

VIII. WOOD PRODUCTS INDUSTRY	
WOOD PROCESSING	
Pulpboard	37,75,84,144,148
Plywood	37,47,84,101,146,148,156,170,245
WOOD PULPING	
Kraft process (sulfate)	9,37,47,75,84,102,144,148,187,196,199,243
Sulfite	
NSSC	
IX. ASSEMBLY PLANTS	
AUTOMOBILE	37,50,75,84,144,148,155
CABLE COVER PRODUCTION	84,148,276,281
CAN MANUFACTURING	144,276,277
LEAD ACID BATTERY	37,39,44,84,148
TYPE METAL PRODUCTION	37,277,278
X. WASTE DISPOSAL (NON-COMBUSTION)	
INDUSTRIAL WASTE HANDLING (LIQUIDS)	
SEWAGE TREATMENT	

APPENDIX 3

COMPUTER PROGRAM
FOR
MODEL IV

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```
      INTEGER L,S
      DIMENSION IRPB(200),IRPC(200),ITU(200),ITA(200),ITS(200)
      DIMENSION ITN(200),ITD(200),IRATNG(2,200),IPLTNT(10,15),PK(200)
      DIMENSION ES(200),EN(200),EU(200),PB(200),A(200),PC(200)
      DIMENSION B(200),C(200),TU(200),TA(200),TS(200),TN(200),TD(200)
      DIMENSION ICUNIT(10,200),IIUNIT(10,200),ISOURC(20,200)
      DIMENSION I5(200),I6(200),IALFA(5,8),IBETA(4,8)

      DATA L,S/1HL,1HS/
      DATA IALFA/2H  ,2HLB,2H/G,2HAL,2H  ,2HLB,2H/E,2H6 ,2HCF,2HT ,
     1           2H  ,2HLB,2H/T,2HON,2H  ,2HLB,2H/E,2H6 ,2HBT,2HU ,
     2           2H L,2H3/,2HBA,2HLE,2H  ,2HLB,2H/B,2HAR,2HRE,2HL ,
     3           2H  ,2HLB,2H/C,2HYD,2H  ,2HLB,2H/P,2HRD,2H U,2HNT/
      DATA IBETA/2HE6,2H G,2HAL,2H  ,2HE6,2H C,2HFT,2H  ,2HE6,2H T,2HON,
     12HS ,2HE1,2H2 ,2HBT,2HU ,2HE6,2H B,2HAL,2HE ,2HB6,2H B,2HBL,2H
     12HE6,2H C,2HYD,2H  ,2HE6,2H P,2HU ,2H  /
      K=1
C** READING IN THE NUMBER OF POLLUTANTS
      READ (1,99) K1
 99   FORMAT(I5)
C** READING IN TABLE NUMBER AND THE NUMBER OF SOURCES OF EACH POLLUTANT
 50   READ (1,100) I1,I2
 100  FORMAT(2I5)
C** READING IN THE NAME OF THE POLLUTANT
      READ (1,101) (IPLTNT(J,K),J=1,10)
  101 FORMAT (10A2)
      DO 750 I=1,I2
C** READING IN THE NAMES OF THE VARIOUS SOURCES AND THEIR RATING
      READ (1,102) (ISOURC(J,I),J=1,20),(IRATNG(J,I),J=1,2)
  102 FORMAT (20A2,2A2)
C** READING IN VARIOUS OTHER INFORMATION (EMISSIONS,PROD. CAPACITY ETC.)
C** FOR EACH OF THE SOURCES
      READ (1,103) PK(I),I5(I),ES(I),EN(I),EU(I),PB(I),
     1IRPB(I),PC(I),IRPC(I),I6(I),A(I)
 103  FORMAT(F7.0,I3,4F10.0,A1,F10.0,A1,I3,E11.0)
      IF (PK(I).EQ.0) GO TO 750
C** DECIDING WHETHER TO USE SIMPLE OR COMPOUND GROWTH TO CALCULATE
C** PROD. CAPACITY FROM CONSTRUCTION AND MODIFICATION
      IF (IRPB(I).EQ.S) GO TO 80
      B(I)=((1.0+PB(I))**10-1.0)*A(I)
      GO TO 81
 80   B(I)=10*A(I)*PB(I)
 81   IF (IRPC(I).EQ.S) GO TO 82
      C(I)=((1.0+PC(I))**10-1.0)*A(I)
      GO TO 83
 82   C(I)=10*A(I)*PC(I)
C** CALCULATING TOTAL EMISSIONS IN TONS/YEAR
 83   TU(I)=(A(I)+C(I))*EU(I)*PK(I)/2.0E6
      IF (ES(I).EQ.0.0) ES(I)=EU(I)
      TA(I)=(A(I)*ES(I)*PK(I))/2.0E6
      TS(I)=((PK(I)*ES(I))*(A(I)+C(I)))/2.0E3
C     IF (EN(I).EQ.0.0) EN(I)=EU(I)
      TN(I)=((PK(I)*ES(I))*(A(I)-B(I))+(PK(I)*EN(I))*(B(I)+C(I)))/2.0E3
      IF (I5(I).EQ.2) GO TO 20
      XL=1.0E6
      TU(I)=TU(I)*XL
      TA(I)=TA(I)*XL
      TS(I)=TS(I)*XL
      TN(I)=TN(I)*XL
C** ROUNDING OFF THE TOTAL EMISSIONS
C     ITU(I)=TU(I)+0.5
C     ITA(I)=TA(I)+0.5
C     ITS(I)=TS(I)/1000+0.5
C     ITN(I)=TN(I)/1000+0.5
   20 TD(I)=(TS(I)-TN(I))
      TS(I) = TS(I)/1000.
      TN(I) = TN(I)/1000.
C** CALCULATING THE ESTIMATED REDUCED EMISSIONS RESULTING FROM NEW
C** OR REVISED NSPS
      IF (TD(I).LT.10.) GO TO 91
      IF (TD(I).GE.1000000.) GO TO 90
      IF (TD(I).GE.100000.) GO TO 89
      IF (TD(I).GE.1000.) GO TO 88
      ITD(I) = TD(I)/10+0.5
      TD(I) = 10*ITD(I)
      GO TO 91
   88 ITD(I)=TD(I)/100+0.5
      TD(I) = ITD(I)
      TD(I) = 100.*TD(I)
      GO TO 91
   89 ITD(I)=TD(I)/1000+0.5
      TD(I) = ITD(I)
      TD(I) = 1000.*TD(I)
      GO TO 91
   90 ITD(I) = TD(I)/10000+0.5
      TD(I) = ITD(I)
      TD(I) = 10000.*TD(I)
 91   I8=I5(I)
      DO 1 J=1,5
```

```
C** OBTAINING THE ACTUAL UNITS OF TOTAL EMISSIONS AND EMISSION RATES
C** FROM THE VARIOUS CODE NUMBERS THAT WERE READ IN AS SUBSTITUTE FOR
C** THE UNITS
 1    IEUNIT(J,I)=IALFA(J,I8)
 92   I9=I6(I)
      DO 2 J=1,4
 2    IIUNIT(J,I)=IBETA(J,I9)
 750  CONTINUE
 93   I=1
      K6=1
      K5=1
C** PRINTING OUT THE RESULTS IN A TABULAR FORM
 322  WRITE(3,300) I1
  300 FORMAT (1H1//15X,5HTABLE,I3,20X,34HPRIORITY RATING SYSTEM:  1975-1
     1985//4X,54HNOTE: 1 IN RATING COLUMN MEANS NO RATING WAS SPECIFIED/
     21X,16HPOLLUTANT/SOURCE,/
     37X,3H(1),17X,3H(2),5X,3H(3),5X,3H(4),3X,3H(5),4X,3H(6),15X,3H(7)/
     430X,14HEMISSION RATES,5X,12HGROWTH RATES,48X,9HEMISSIONS/
     514X,8HEMISSION,7X,13HALLOWABLE   UNCONT,2X,12HDECIMAL/YEAR,2X,
     628HINDUSTRY CAPACITY/PRODUCTION,10X,14H1000 TONS/YEAR,8X,
     79HTONS/YEAR)
      WRITE (3,301)
  301 FORMAT (1X,8HRATING K,6X,5HUNITS,8X,1HE,7X,1HE,7X,1HE,5X,1HP,6X
     11HP,7X,5HUNITS,5X,1HA,5X,1HB,5X,1HC,4(7X,1HT),6X,4HT -T/
     229X,1HS,7X,1HN,7X,1HU,5X,1HB,6X,1HC,37X,1HU,7X,1HA,7X,1HS,7X,1HN,
     36X,4HS  N)
      WRITE (3,302) (IPLTNT(J,K),J=1,10)
  302 FORMAT (1X,10A2)
      I=K5
 323  WRITE (3,303) (ISOURC(J,I),J=1,20)
  303 FORMAT (/1X,20A2)
      IF (PK(I).EQ.0.0) GO TO 330
      IF (A(I).GE.1000. .OR. B(I).GE.1000. .OR. C(I).GE.1000.) GO TO 305
      WRITE (3,304) (IRATNG(J,I),J=1,2),PK(I),(IEUNIT(J,I),
     1J=1,5), ES(I),EN(I),EU(I),PB(I),IRPB(I),PC(I),IRPC(I),
     1(IIUNIT(J,I),J=1,4), A(I),B(I),C(I),TU(I),TA(I),TS(I),TN(I),TD(I)
  304 FORMAT (1X,2A2,F5.2,3X,5A2, 3F8.3,2(F6.3,A1),3X,4A2,3F6.1,1X,
     14F8.1,F9.0)
      GO TO 330
  305 IA = A(I)+0.5
      IB = B(I)+0.5
      IC = C(I)+0.5
      WRITE (3,306) (IRATNG(J,I),J=1,2),PK(I),(IEUNIT(J,I),
     1J=1,5), ES(I),EN(I),EU(I),PB(I),IRPB(I),PC(I),IRPC(I),
     1(IIUNIT(J,I),J=1,4),IA,IB,IC,TU(I),TA(I),TS(I),TN(I),TD(I)
  306 FORMAT (1X,2A2,F5.2,3X,5A2, 3F8.3,2(F6.3,A1),3X,4A2,3I6,
     13F8.0,F7.0,F11.0)
 330  K5=K5+1
      I=I+1
      IF (I.GT.I2) GO TO 324
      K7=15*K6
      IF (K5.GT.K7) GO TO 327
      GO TO 323
 327  K6=K6+1
      GO TO 322
 324  K=K+1
      IF (K.GT.K1) GO TO 359
      GO TO 50
 359  CALL EXIT
      END
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TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA 450/3-76-017	2.	3. RECIPIENT'S ACCESSION NO. PB 80 194657
4. TITLE AND SUBTITLE Impact of New Source Performance Standards on 1985 National Emissions from Stationary Sources		5. REPORT DATE April 1977
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Thomas G. Hopper William A. Marrone		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS TRC - The Research Corporation of New England 125 Silas Deane Highway Wethersfield, Connecticut 06109		10. PROGRAM ELEMENT NO. 2AC129
		11. CONTRACT/GRANT NO. 68-02-1382
12. SPONSORING AGENCY NAME AND ADDRESS EPA-Office of Air Quality Planning and Standards Emission Standards and Engineering Division Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 7/74 - 7/76
		14. SPONSORING AGENCY CODE EPA - OAQPS
15. SUPPLEMENTARY NOTES Project Officer for this Report is G. D. McCutchen, Mail Drop 13, Ext. 271		

16. ABSTRACT

The purpose of this document is to present the results of a study to determine the impact of new source performance standards on nationwide emissions. The work presented covers 14 potential pollutants from approximately 200 source categories for the year 1985. The results are being used by EPA as input to the development of an overall standard setting strategy. The report contains information regarding controlled and uncontrolled emission factors, State emission limitations, industrial capacity, utilization, growth and retirement rates. The results of this study have been published as three volumes which encompass ten separate documents. This document contains the main text and Apendices I through III of Volume I. All input/output variables and results are summarized and tabulated in this volume.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS		c. COSATI Field/Group
Air Pollution Air Pollution Control Industrial Processes Combustion Regulations Economic Factors	Priorities Chemical Industry Paper Industry Petroleum Industry	Metal Industry Agricultural Mineral Flyash Exhaust Gases	

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (9-73)

*U.S.GOVERNMENT PRINTING OFFICE: 1977-740110/302 REGION NO. 4